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ABSTRACT

This booklet was produced in an effort to increase the awareness and appreciation of young people for the Earth's resources. The Mining Education Glossary is intended to provide easy reference to mining terms which are used in the minerals recovery industry and as a useful resource for teaching basic learning skills. Accompanying the glossary are 28 mining games designed to help students at all grade levels learn language arts skills including spelling, vocabulary development, word usage, pronunciation and the meanings of words that might be used in various related study units. Activities involve students in word search games, crossword puzzles, and other language and word power learning experiences. Activity instructions are designed for students and allow for independent study. Each activity also contains teacher information. (LZ)

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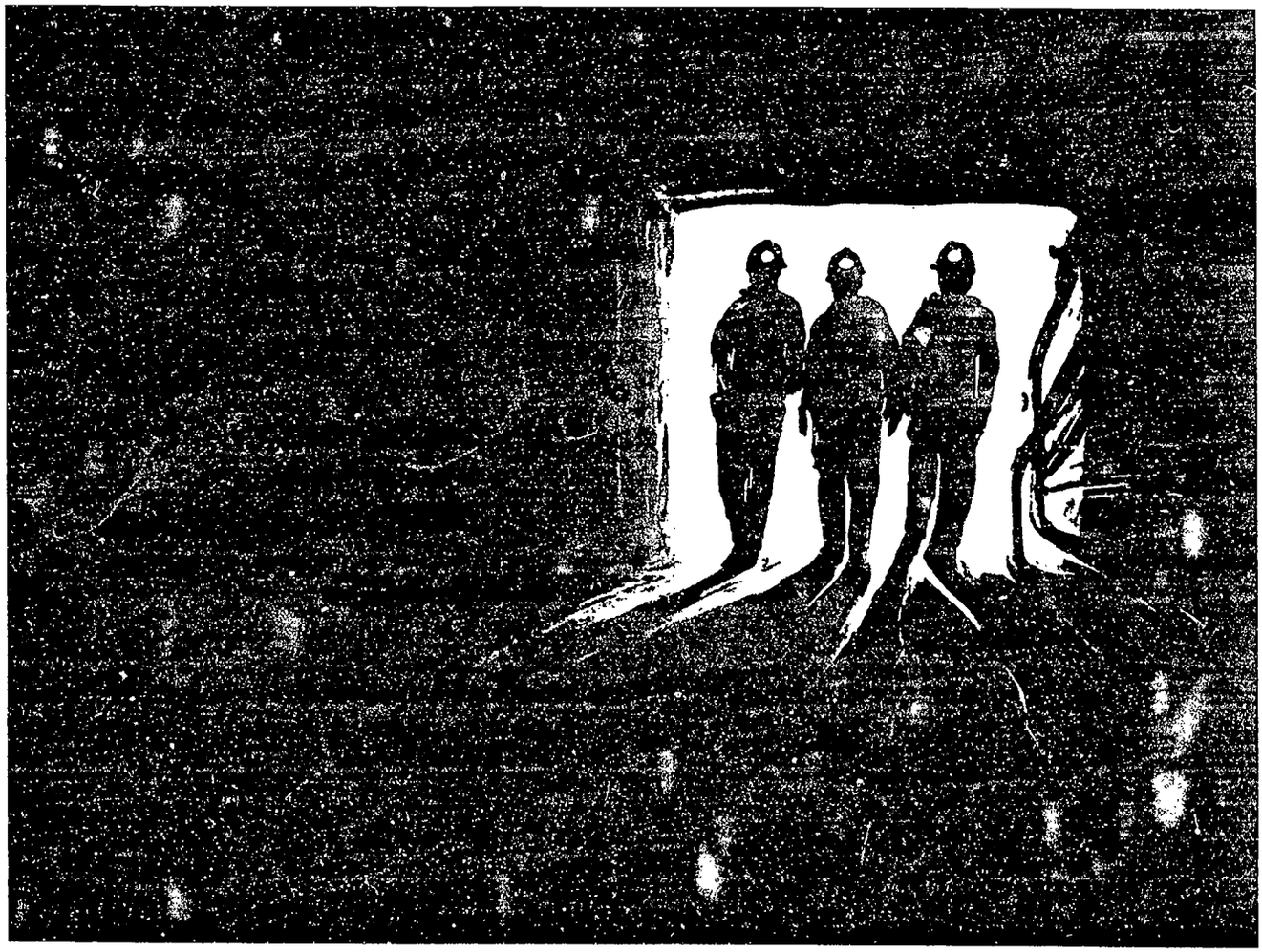

MINING GLOSSARY

AND GAMES

MINING (mining) The science, technology, and business of mineral discovery, extraction and marketing.

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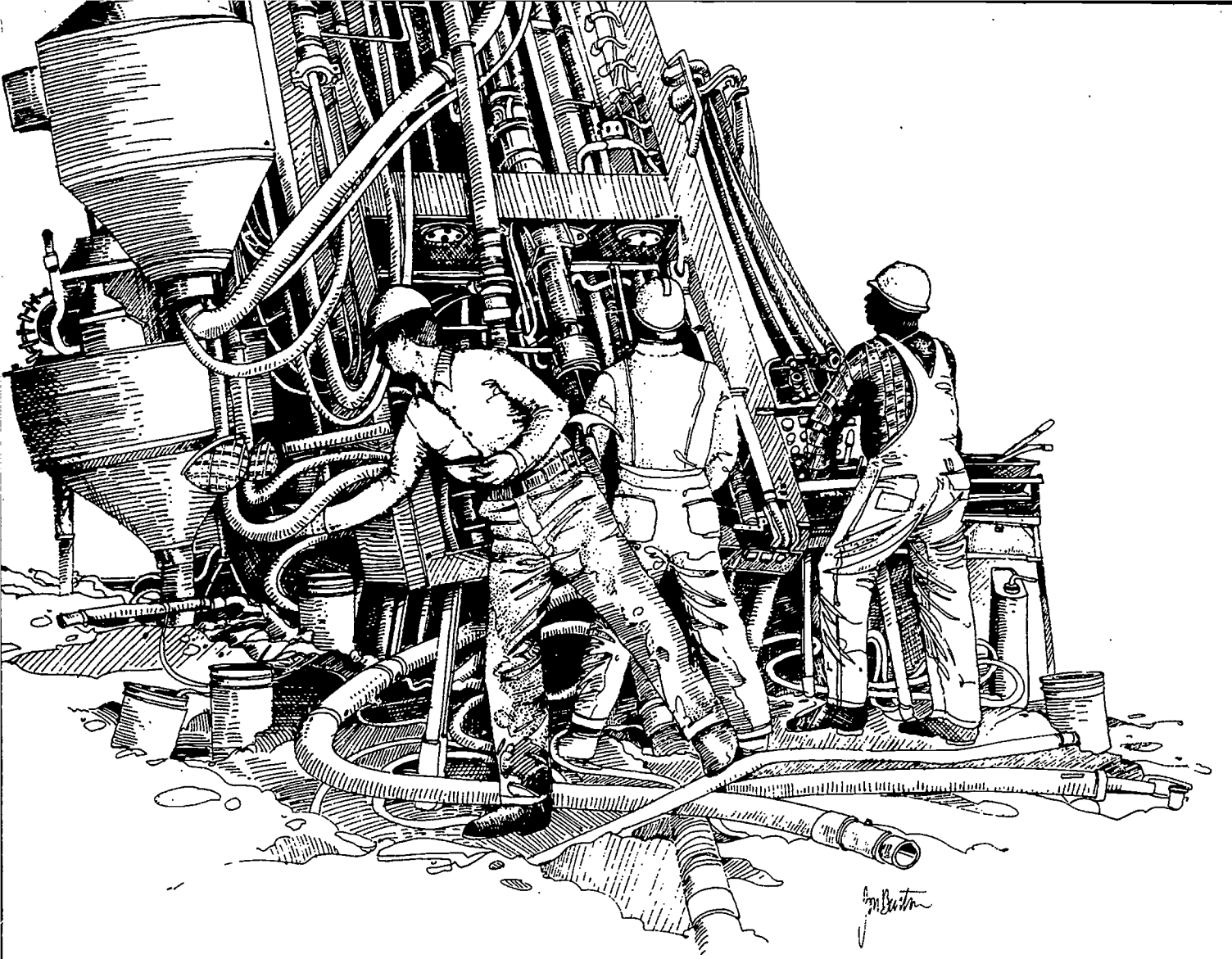

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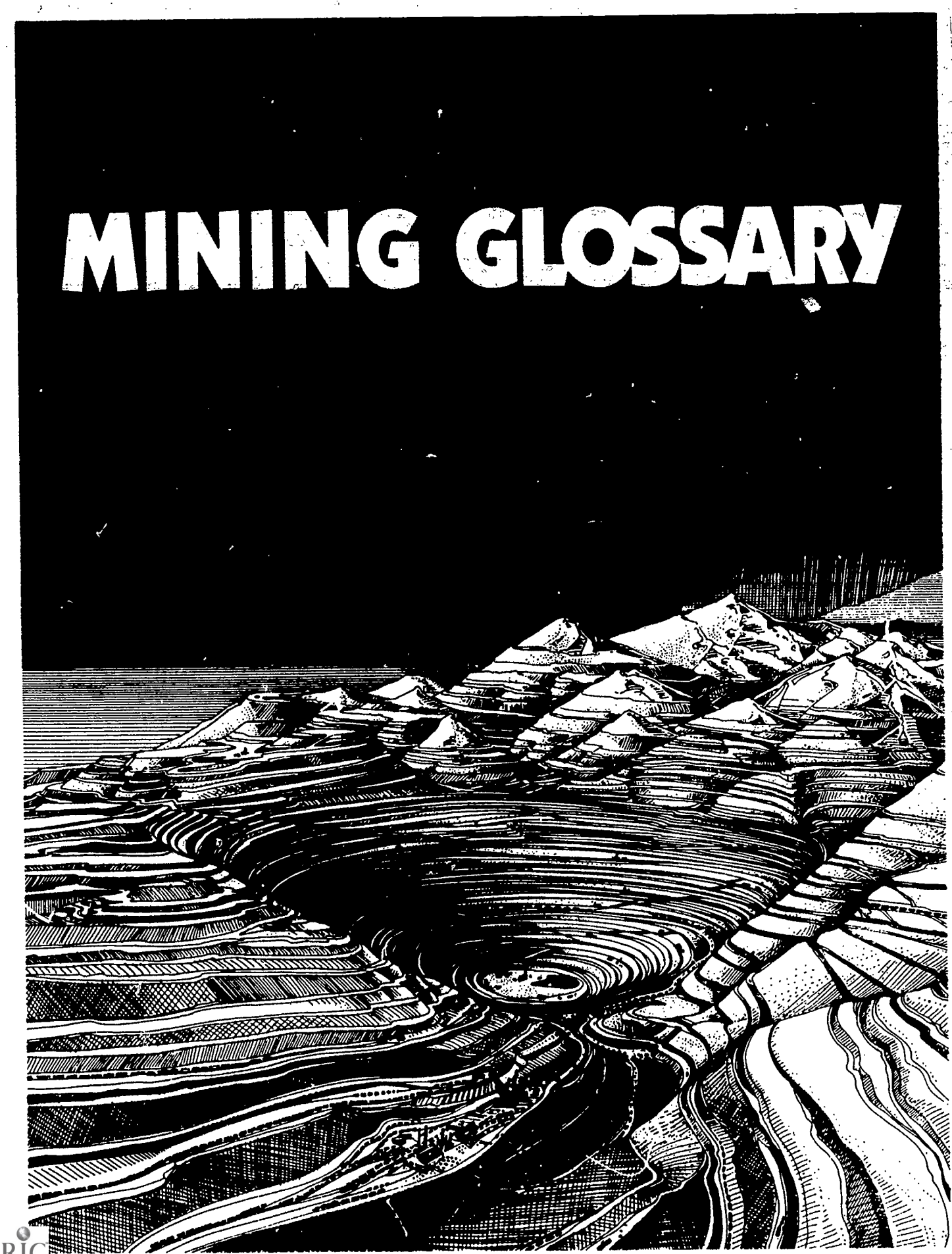
MINING GLOSSARY



MINING GLOSSARY AND GAMES

Those who grew up on movies of the wild west remember many settings involving the rough-and-tumble life of people in mining towns. Whether the scene depicted a calm endeavor to pan a living of gold from a stream, or a heartless murder by claim-jumpers trying to make it big with a rich vein of ore without paying the miserable price of prospecting, the settling of the west (and many parts of the east and south) had their roots in mining. Actually, it was the precious metals which beckoned great numbers of pioneers to leave comfortable homes and secure jobs in the east to explore and conquer the frontier.

As is true of many other facets of life, modern technology has propelled the mining business from hand-to-hand combat with nature to a process largely automated. Those involved have, to a great extent, set aside their picks and shovels in preference of the brute force of powerful machinery, and traded their crude prospecting techniques for computerized instruments that greatly ease the task of locating precious resources hidden beneath the ground.

Although the west has been won, mining still plays an extremely important role in the economy and activity of the United States. We rely heavily on its products for both the niceties and the necessities of life. Understanding something about what is involved in acquiring those resources requires more than a passing reference to mining as it was done in the days of the early settlers. It requires a deliberate effort to explore, through books, stories, discussion, and where possible visits to the site of some of those resources--and it requires some degree of literacy in the terminology related to the minerals and mining industry.

PURPOSE

These materials have been produced in an effort to increase the awareness and appreciation of young people for the earth's resources, and for those who work so hard to bring them to us in a usable form. Literacy in the natural resources must include the processes of making them available. The MINING EDUCATION GLOSSARY focuses on many mining terms which are used in a profession and process important to all of us.

This GLOSSARY is part of an interrelated set of educational resources prepared for teachers by the National Energy Foundation. The GLOSSARY will provide easy reference to mining terms which are used in the minerals recovery industry. The GLOSSARY also provides a useful resource for teaching basic learning skills. For the creative educator, this document contains a wide variety of organizing, classifying and related learning opportunities. Add interest to your instruction by using the MINING GLOSSARY to create word search games, crossword puzzles, and other language and word power learning experiences.

ACKNOWLEDGEMENT

This GLOSSARY reflects the work of many people. The terms and definitions have been extrapolated and adapted from a wide variety of resource materials and common usage. We express our appreciation for the assistance and expertise of all who have contributed to its completion. Special thanks should be extended to members of the project development team including: Dr. Marvin Tolman - Brigham Young University, Paul Iverson - Nevada State Department of Minerals, David Barna - Bureau of Mines, Washington DC, Rex Curtis, Jon Burton - Art and Design, NEF, Ray Cornia - Project Coordinator, and Don Lochhead, Editor.

THE NATIONAL ENERGY FOUNDATION

The National Energy Foundation is a nonprofit education organization. The mission of NEF is to provide cost-effective supplementary educational resources to aid educators in the teaching process; conduct motivating teacher training programs to assist teachers; give students incentives to participate more intensely in the learning process; and provide the means for corporations, government agencies and associations to participate in the improvement and enhancement of education.

A

ABANDON: (1) To stop drilling and remove the drill from the site before reaching the proposed depth. (2) To give up maintaining a property.

ABATE: In metalworking, to lower the temperature of the metal.

ABERRATION: A flaw in a stone, usually a gem stone.

ABLATION: (1) The formation of a deposit by the washing away of loose or soluble minerals. (2) The decreasing of the size of a glacier by all the combined processes working on it.

ABRADE: To rub, wear off, waste or wear away by friction. The wearing away of diamond or drill bit equipment by the friction with rock materials being cut or drilled.

ABRASION: The wearing away by friction or rubbing, as water carving sand or glaciers cutting rock and grinding it up.

ABRASIVE: The substance used for grinding, polishing, or pressure blasting. For preparing polished surfaces. May be natural diamonds, corundum, emery, etc., or man-made aluminum oxide, silicon carbide, and boron carbide.

ABSOLUTE: Term used in the trades to indicate a thing as being perfect or exact.

ABSORBENT: A substance that will absorb, drink in or, soak up a liquid like a sponge.

ACCUMULATOR: A cylinder containing water or oil under pressure of a weighted piston for hydraulic pressure.

ACID: Substances which typically are soluble in water; sour, sharp, or biting to the taste; and which turn litmus paper red.

ACRE: A measure of surface area, usually of land. It contains 43,560 square feet (4840 square yards or 160 square rods).

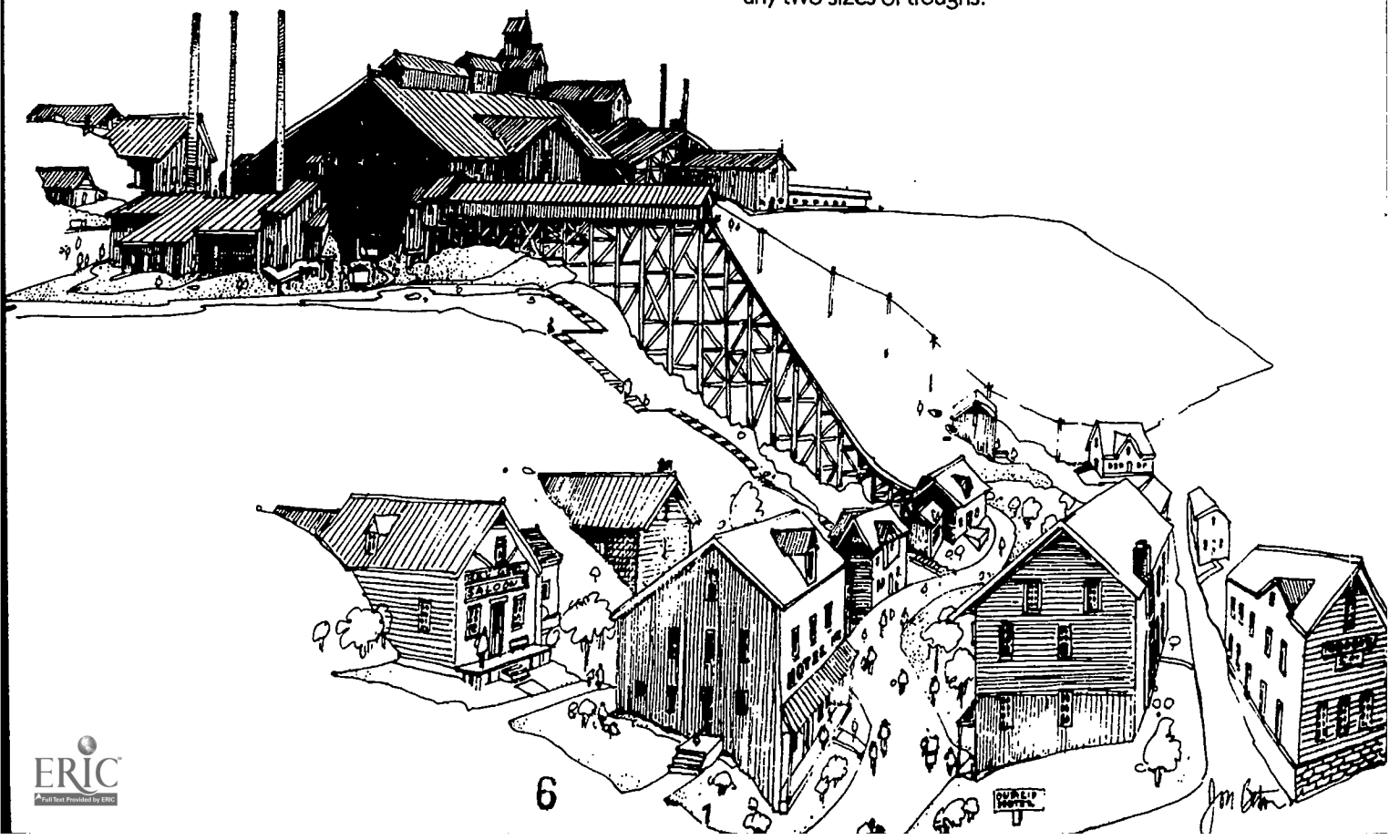
ACRE-FOOT: The amount of water that would cover 1 acre of land, 1 foot deep. 325,829 U.S. gallons.

ACRE-INCH: The volume of water, soil, or other material that will cover 1 acre, 1 inch deep.

ACRE-YIELD: The average quantity of gas, oil, or water recovered from 1 acre of a reservoir. The quantity of any product obtained from 1 acre.

ADAMITE: A basic zinc arsenate mineral that has a slight arsenic smell. It has a brilliant fluorescence.

ADAPTER TROUGH: A short section of a shaker conveyor trough that serves as a connecting link between any two sizes of troughs.



ADIT: A nearly horizontal passage from the earth's surface into a mine.

ADOBE: A (sun-dried) brick that is made of clayey and silty deposits. A deposit found in the desert basins of southwestern United States and in Mexico. The material is used extensively for making sun-dried brick.

AERATE: To expose to air by passing air through it. It can be accomplished by stirring, spraying, or bubbling air into a substance.

AERIAL MAPPING: The taking of continuous vertical photographs from an airplane for geophysical and other purposes.

AFTERCOOLER: A device for cooling compressed air between the compressor and the mine shaft.

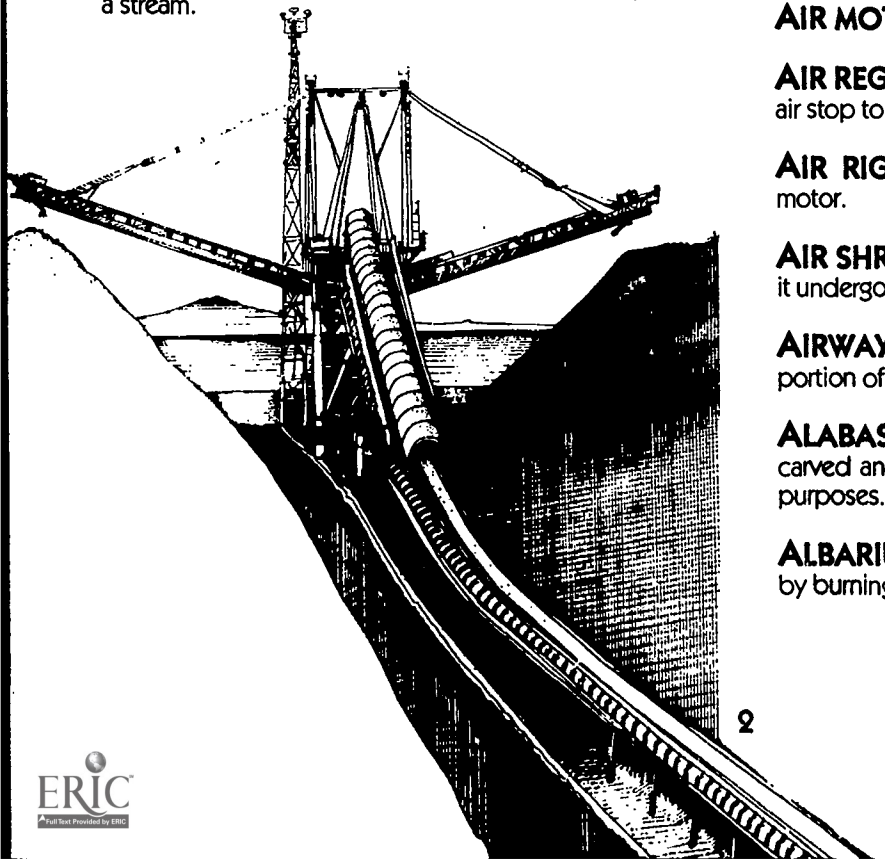
AFTERGASES: Gases produced by mine explosions or mine fires.

AFTERSHOCK: The shocks produced following an earthquake or blasting. They are usually less in energy than the original shock. They continue for a period of time after the quake or blast.

AGENT: The manager of a mining property.

AGGRADATION: The natural filling up of the bed of a water course by deposition of material carried by the stream. The process may change a water course.

AGGRADATION PLAIN: A very broad plain of deposition in arid districts deposited by material carried by a stream.



AGGREGATE: Uncrushed or crushed gravel, crushed stone or rock, sand, or artificially produced inorganic materials which form a major part of concrete.

AGING: To become old; to show the effects or characteristics of increasing age.

A-HORIZON: The uppermost layer of soil from which soluble salts have been leached and in which organic matter has accumulated which is conducive to plant growth.

AIR COMPRESSOR: A machine which draws in air at atmospheric pressure, compresses it, and delivers it at a high pressure.

AIR CONDITIONING: To control in a limited area the quantity, quality, and temperature-humidity of the air.

AIR DUCT: A pipe or tubular channel for conveying air, usually from a fan to a point of use.

AIR GATE: An air regulator or an underground roadway in a mine used for ventilation.

AIRHAMMER: A tool in which a hammer head is activated by means of compressed air. The air is conducted to the tool through a hose from a compressor. A trigger starts or stops the air to the hammer.

AIR LANCING: Air blasting; the removal or cutting away of loose materials by means of compressed air.

AIR MACHINE: A machine for forcing fresh air into a mine and withdrawing bad air from a mine as a fan.

AIR MOTOR: A motor driven by compressed air.

AIR REGULATOR: An adjustable door in a permanent air stop to control the air currents.

AIR RIG: A drill machine powered by an air-driven motor.

AIR SHRINKAGE: The decrease in a volume of clay as it undergoes drying.

AIRWAY: Any underground passage through which a portion of air is carried.

ALABASTER: A form of gypsum that can be easily carved and polished. Is frequently used for ornamental purposes. Its chemical formula is $CaSO_4.2H_2O$.

ALBARIUM: White lime used for stucco which is made by burning marble.

ALCHEMY: Chemistry of the Middle Ages based on the pursuit of changing base metals into gold.

ALCOVE: A large, deep niche formed by a stream of water in a face of horizontal strata.

ALIEN FILLING: Fill material brought from the surface or some other place other than the mine.

ALINE: To position a drill so that it is centered on a point and parallel to a predetermined angle and compass direction. Also called to "line in" or "line up".

ALKALI: A substance that dissolves in water to form a base solution with a PH greater than 7. Primarily hydroxides of sodium and potassium. They neutralize acids and form salts with them.

ALKALINE: Having the qualities of a base and turns red litmus paper blue.

ALLIGATOR: A safety clamp. Any of several types of machines used for rock crushing or metalworking that has two massive jaws, one or both that move.

ALLIGATOR HIDE: A defect of extreme roughness in a porcelain enamel surface.

ALLOWANCE: Living expense or primary wage paid to crews living in remote areas under rigorous conditions. Refreshments supplied by the owners of a mine and given to workman having to work under unusual conditions.

ALLOY: A mixture of metals.

ALLUVIA: Materials such as loose gravel, sand, and mud deposited by streams.

ALLUVIAL DEPOSITS: Earth, sand, gravel, or other rock or mineral materials transported by and laid down by flowing water.

ALLUVIAL MINING: The exploitation of alluvial deposits by dredging, hydraulicking, or drift mining.

ALLUVIAL PLAIN: A formation resulting from the deposition of alluvium by water. In the southwestern United States they are formed by streams having a considerable grade which carry alluvium into valleys. As the grade becomes less the stream slows down and deposits the alluvium in a fan shape deposit at the mouth of a canyon. They are sometimes called "alluvial slopes" or "fans".

ALLUVIAL SLOPE: The surface of alluvium that slopes away from the sides of mountains and merges with the plain or valley floor.

ALLUVIAL STONE: A rock that has been transported and deposited by water.

ALPINE: Pertaining to or like a lofty mountain or range of southern Europe. Implies high elevation, particularly above the tree line, and it has a cold climate.

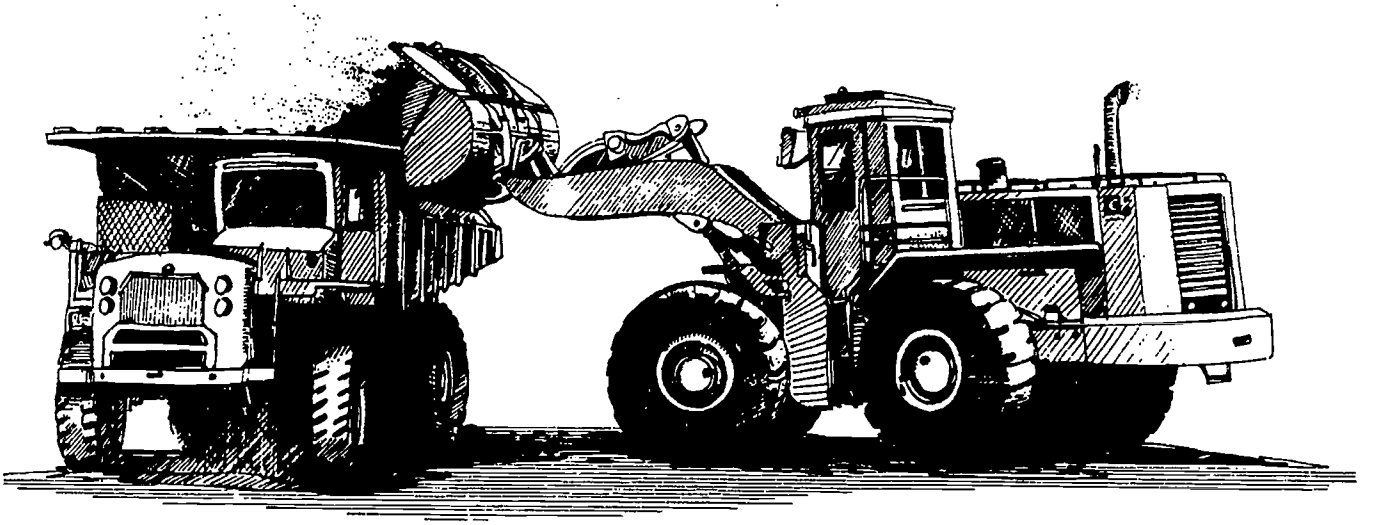
ALTERNATING CURRENT: Electrical current, the direction of which is reversed at regular intervals, usually 120 reversals per second or 60 cycle electrical current.

ALTERNATOR: A generator producing alternating electrical current by the rotation of its rotor.

ALTIMETER: An instrument used to measure altitudes.

ALTITUDE: The height of a point above some reference point. Usually, it is the height above sea level.

ALUMINIZING: The forming of an aluminum or aluminum alloy coating in a metal, by hot dipping, hot spraying, or diffusion.



ALUMINUM: A light, silvery-white metal with high electrical conductivity and good resistance to corrosion. It is obtained from bauxite.

ALUMINUM GOLD: A ruby red alloy containing 22 percent aluminum and 78 percent gold.

ALUMINUM THERAPY: A therapy intended for prevention of silicosis. It provides for the inhalation of powdered aluminum and alumina dust by miners in the change house. The aluminum forms a complex, inactive silicate with silica dust particles in the lungs, coating each particle with an inert layer of aluminum oxide.

AMBIENT: The environment surrounding a body but undisturbed or unaffected by the body.

AMIGO: A stick tied to the end of a rope on which men sit when being raised or lowered in a shaft. This technique may be illegal in some locations.

AMMETER: An instrument for measuring electric current in amperes.

AMMONIA: A colorless, gaseous alkaline compound, NH_3; lighter than air, pungent smell and taste; very soluble in water. Can be easily condensed by cold and pressure. Used in making fertilizers and explosives.

AMORPHOUS: Without form; applied to rocks and minerals having no definite crystalline structure.

AMORPHOUS SYSTEM: A substance in which the crystalline form is absent, for example, glass, charcoal, or pitch.

AMORTIZATION: In the mining industry, amortization is a process of estimating whether an investor is justified in risking a sum of money to purchase a mine or its equipment.

AMPERE: A unit of electrical current produced by 1 volt acting through a resistance of 1 ohm.

ANABRANCH: When the water of a stream splits and rejoins the main stream leaving an island between the two water courses.

ANALOGOUS OR ANALOGUS: Resembling something else in some way as in form or proportion.

ANALOGY: Comparison between two effects, for example, alternating current is used as an analogy in the study of tides but is based on resemblance.

ANALYZE: To study or determine the nature and relationships of the parts by analysis. To separate into parts or elements for study.

ANCHOR: To fasten down or hold in place.

ANCHOR BOLT: A bolt with the threaded portion projecting from a structure that is used to hold a building or a machine against the force of vibration.

ANCHOR CHARGE: Means of fastening an explosive charge in a seismic shot hole to allow several charges to be preloaded.

ANCHORED DUNE: A sand dune stabilized by the growth of vegetation.

ANDESITE: A volcanic rock composed essentially of andesine, which is a silicate of sodium, calcium, and aluminum.

ANEMOMETER: An instrument used to measure air velocity or wind. It is a small fan which rotates by air current.

ANEROID BAROMETER: An instrument used to measure atmospheric pressure.

ANNEAL: To heat, fire, bake, or fuse, as glass, earthenware, ore, etc. To fix colors or to toughen them and remove brittleness.

ANODE: (1) The positive terminal of an electric cell where electrons leave a device to enter the external circuit. (2) The negative terminal of a cell or a storage battery that is delivering current.

ANODE METAL: Metals used for electroplating. They are as pure as possible, uniform in texture and composition.

ANODIZED ALUMINUM: Aluminum which has been made the anode of an electrolytical chemical bath. The aluminum is chemically oxidized on the surface, giving it a fine matte appearance.

ANT HILL: In blast-hole drilling, the cuttings around the hole collar.

ANTHRACITE: A hard, black lustrous coal containing a high percentage of fixed carbon and a low percentage of volatile matter. Commonly referred to as hard coal.

ANTICLINE: Strata or rocks which dip in opposite directions from a common ridge or axis, like the roof of a house.

ANTIDUNE: A sand wave that travels against the current instead of with it. Its downstream slope is eroded and its upstream slope receives deposits.

ANVIL: A heavy, usually steel faced iron block, on which rock or metal is crushed or shaped by hammering.

APOSTLE GEM: Gems that were used in the Middle Ages to symbolize the apostles. Example: St. John-emerald, etc.

APPALACHIAN COALFIELD: The coal producing area extending from northern Pennsylvania to Alabama, in and adjacent to the Appalachian Mountains.

APPLE COAL: Soft or loose coal which is easily mined and breaks into small apple-sized lumps.

ASPHALT: A bitumen of variable hardness and comparatively nonvolatile.

AQUAMARINE: A pale blue (gem) variety of beryl.

AQUEDUCT: A conduit or pipe for carrying water over long distances.

AQUEOUS: Of, or relating to, or having the characteristics of water. Made from, with, or by means of water.

ARBOR: A shaft on which a revolving cutting tool is mounted.

ARBORESCENT: Applied to minerals having treelike form, especially when fairly massive.

ARCH: A portion of rock left standing at the intersection of a wall and roof, usually to support the roof.

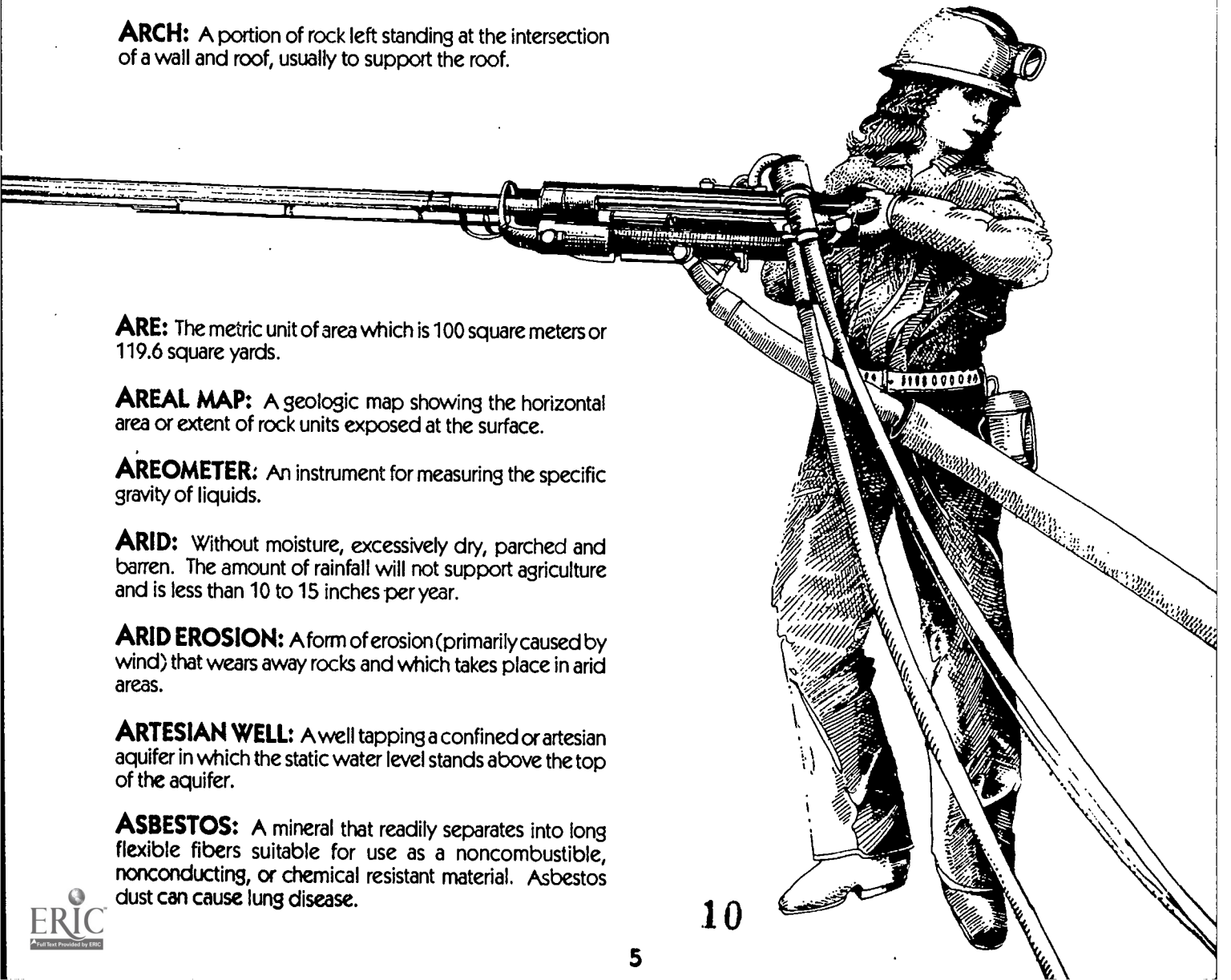
ASH: The solid residue left when combustible material is burned. Volcanic dust and particles less than 4mm in diameter.

ASSAY: To test ores or minerals by chemical or blowpipe examination to determine the metals in the ores and the ores that should be smelted.

ASSAYER: One who analyzes ore and alloys to determine the value and properties of their precious metals.

ATTRITION: (1) The condition of being worn down or of being ground down by friction. The agent for movement could be wind, stream currents, waves, or glaciers. (2) The removal of ice from a glacier by melting or evaporation.

AUGER: A drill modeled after a carpenter's screw auger used for drilling seismic shotholes or geophone holes where the cuttings are removed.



ARE: The metric unit of area which is 100 square meters or 119.6 square yards.

AREAL MAP: A geologic map showing the horizontal area or extent of rock units exposed at the surface.

AREOMETER: An instrument for measuring the specific gravity of liquids.

ARID: Without moisture, excessively dry, parched and barren. The amount of rainfall will not support agriculture and is less than 10 to 15 inches per year.

ARID EROSION: A form of erosion (primarily caused by wind) that wears away rocks and which takes place in arid areas.

ARTESIAN WELL: A well tapping a confined or artesian aquifer in which the static water level stands above the top of the aquifer.

ASBESTOS: A mineral that readily separates into long flexible fibers suitable for use as a noncombustible, nonconducting, or chemical resistant material. Asbestos dust can cause lung disease.

B

BABLE CLAMP: A U-shaped steel rod with threaded ends and a bar with nuts, provided to clamp over two or more cylindrical pieces to bind them together.

BACKFILL: (1) Materials excavated from a site and reused for filling the original excavation. (2) To fill an excavation.

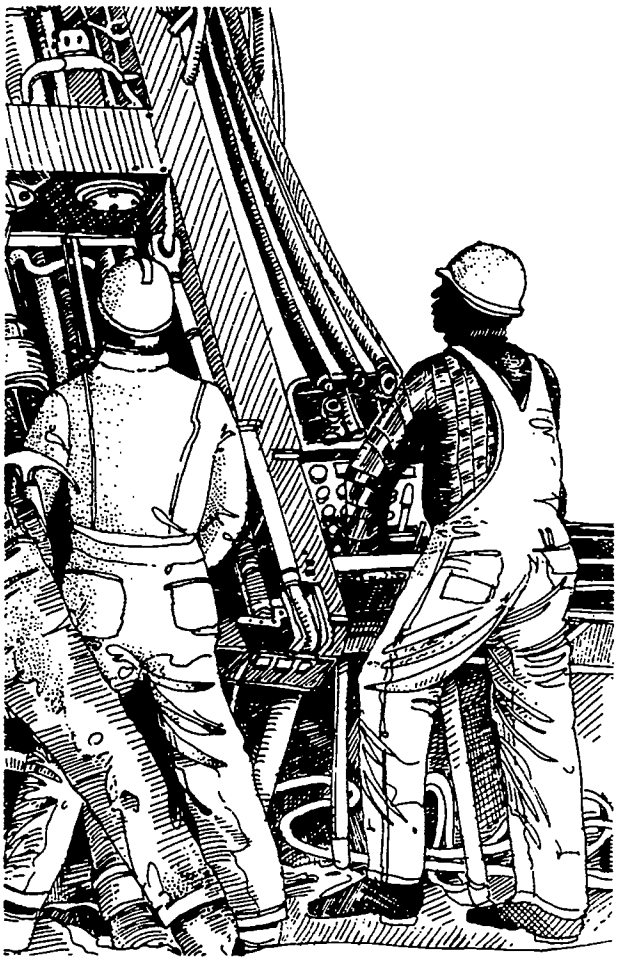
BAD AIR: Air filled with powder fumes, noxious gases, or improperly ventilated.

BAFFLE PLATE: (1) A loading plate attached to the frame of a belt conveyor to prevent spillage at any loading point. (2) It may also be used to direct heat in a furnace or the flow of liquids in processing equipment.

BALLAST: Heavy material such as water, sand, or iron which has no function in a machine except the increasing of weight.

BALLISTIC EFFECT: The throwing of rock a distance from the exploded charge; a thing to be avoided in rock blasting.

BAND: Any well-defined and widespread thin rock deposit which may or may not be fossiliferous and is of value in correlating geological structure.



BANKMAN: In the brick, tile, and nonclay refractories industry, one who performs general duties in and about a clay pit or clay bank.

BANKSWOMEN: A woman employed at the mine to pick rock from coal and clean the coal for market.

BAR: (1) A drilling or tamping rod. (2) A vein or dike crossing a lode. (3) A bank of sand, gravel, or other matter, especially at the mouth of a river or harbor, often obstructing navigation.

BAR BENDER: (1) A skilled tradesman who cuts and bends steel reinforcement, and who binds it in the required position prior to the concrete being poured around it. (2) A machine for bending bar stock.

BARGE LOADER: In the mining industry, a laborer who controls the movement of a barge in a river as it is loaded with crushed rock.

BAR GRIZZLY: A series of spaced bars, rails, pipes, or other members used for rough sizing of bulk material.

BAR MINING: The mining of river bars, usually between low and high waters.

BARNEY: A small car, or truck, attached to a rope and used to push cars up a slope.

BARNEY PIT: A pit at the bottom of a slope or plane, into which the barney is lowered to allow the mine car to run over it to the foot of the plane.

BAROMETER: An instrument for measuring atmospheric pressure. There are two general types: mercury and aneroid.

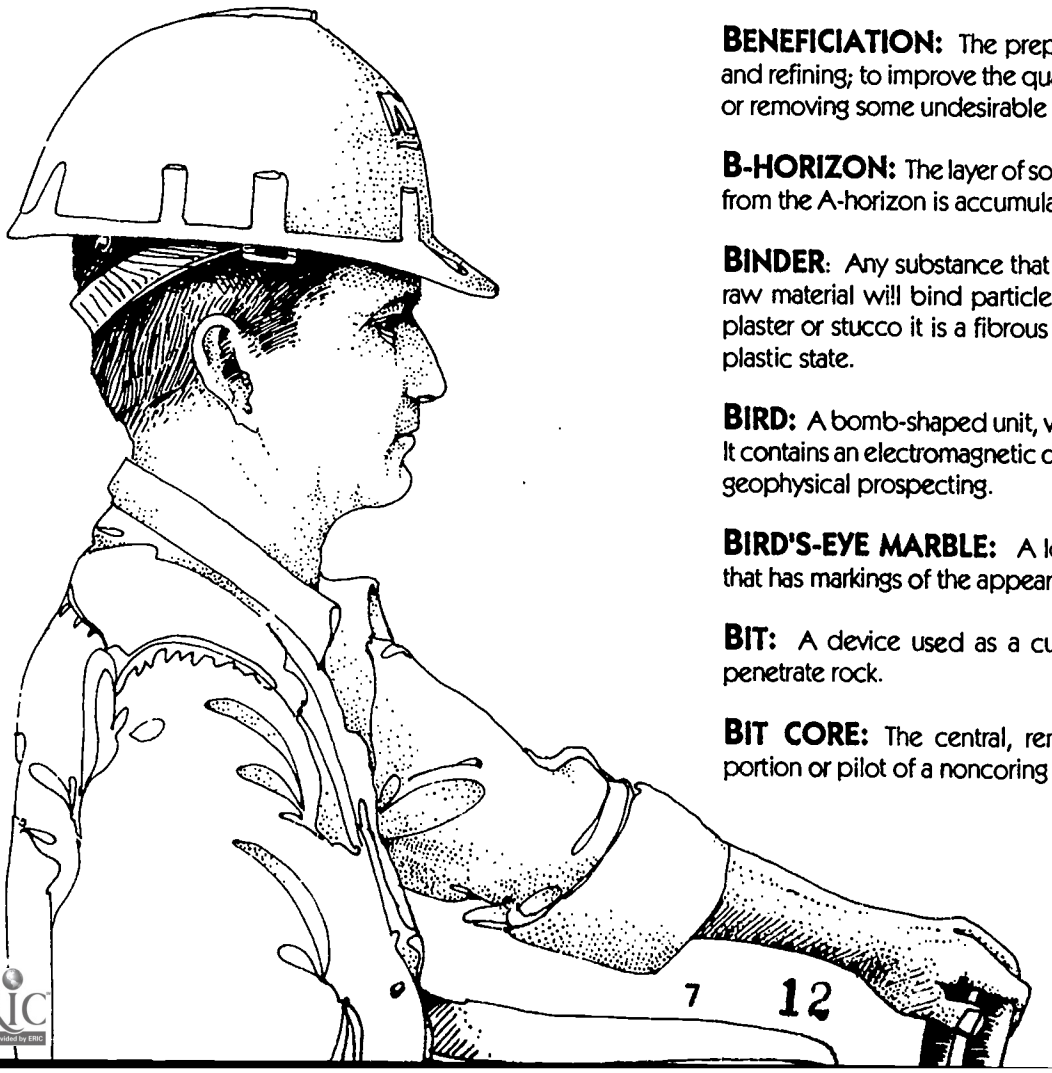
BAROMETER HOLIDAY: Any day on which no work is carried on underground, owing to the very low state of the barometer (usually 29 inches) because methane gas may be expected to build up in the mine under these conditions.

BARREN MINE: A mine where the veins contain little or no valuable ore. It is impossible to work the mine for a profit.

BASALT: The dark gray or black dense to fine-grained igneous rock that is extruded from a volcano or volcanic vent.

BASEMENT: In geology, an underlying complex of rock that behaves as a unit mass and does not deform by folding.

BAT: (1) A brick or other ceramic shape which is rejected because of defects. (2) A compact black shale that splits into fine layers.



BATTEN: A strip of wood used for nailing across two other pieces to seal or reinforce a joint.

BATTER: (1) The inward slope from bottom to the top of the face of a wall. (2) Applies to masonry or of any inclined portion of a frame or metal structure.

BATTERY OF OVENS: A row or group of ovens for making coke from coal.

BAUXITE: A rock composed of aluminum hydroxides. The principal ore of aluminum.

BEAM: A bar or straight girder used to support a span of roof between two support props or walls.

BEARING BEDS: Beds that contain or are likely to contain ore, minerals, etc.

BEHEAD: In geology, to cut off and capture by erosion an upper portion of a water course by a stronger stream.

BENCH CLAIM: A placer claim located in a bench above the present level of a stream.

BENCH: (1) One of two or more divisions of a coal seam. (2) A level layer worked separately in a mine.

BENEFICIATION: The preparation of ore for smelting and refining; to improve the quality of the ore, as by sizing or removing some undesirable materials.

B-HORIZON: The layer of soil in which material leached from the A-horizon is accumulated.

BINDER: Any substance that when added to a ceramic raw material will bind particles together. In the case of plaster or stucco it is a fibrous material added during the plastic state.

BIRD: A bomb-shaped unit, weighing about 70 pounds. It contains an electromagnetic detection coil, used in aerial geophysical prospecting.

BIRD'S-EYE MARBLE: A local name given to marble that has markings of the appearance of a bird's-eye.

BIT: A device used as a cutting tool to bore into or penetrate rock.

BIT CORE: The central, removable, and replaceable portion or pilot of a noncoring type of bit.

BITUMEN: A general name for various solid and semi-solid hydrocarbons.

BITUMINOUS: Containing much organic or carbonaceous matter, mostly in the form of tarry hydrocarbons usually described as bitumen.

BITUMINOUS COAL: Soft coal which is high in carbonaceous matter, having between 15 and 50 percent volatile matter. A high quality coal, dark brown to black in color.

BITUMINOUS MATERIAL: Materials containing bitumen as an essential constituent.

BLACK COAL: Coal slightly burned by igneous rock, sometimes known as natural coke.

BLACK COPPER: A name given to the more or less impure metallic copper produced in blast furnaces when running on oxide or roasted sulfide materials.

BLACK DIAMOND: A variety of crystalline carbon, related to diamond, but showing no crystal form. It is used as an abrasive because of its hardness.

BLACK GOLD: Free gold coated with a film of black oxide of manganese. The yellow color is not visible until coating is removed.

BLACKLUNG: A lung disease found in miners from prolonged breathing of coal dust.

BLASTING: The operation of breaking coal, ore, or rock by boring a hole in it, inserting an explosive charge, and firing it.

BLASTING CAPS: A shell, frequently made of copper, closed at one end and containing a charge of detonating compound. This is ignited by an electric current or the spark of a fuse.

BLASTING FUSE: A fine core of gunpowder enclosed in the center of jute, yarn, etc., for igniting an explosive charge.

BLENDING: Mixing in predetermined and controlled quantities of different materials to give a uniform product.

BLIND DRIFT: A horizontal passage in a mine, not yet connected with the other workings.

BLIND OUTCROP: An outcrop buried under the surface soil or sedimentary rock, only exposed by stripping overburden or pitting.

BLOCK CAVING: A way of mining such ores as copper and iron ore when they are scattered throughout the waste material.

BLOOM: (1) A mineral that is frequently found as efflorescent salts on the surface of the earth in dry weather after rain or irrigation. (2) Semifinished hot-rolled product, rectangular in cross section. For iron and steel, the width is not more than twice the thickness.

BLOOMER: The mill or equipment used in reducing steel ingots.

BONANZA: Good luck, or a rich body of ore.

BONE: In the anthracite-coal trade, a carbonaceous shale containing 40 to 60 percent of noncombustible materials.

BOOM: A long beam attached to a tripod or derrick and extending out over the work surface. With it, heavy drill tools and other equipment can be safely handled.

BOOMER: An oilfield worker who migrates from one boom field to another. A member of a drill crew who works on one job a short time, quits, and moves on.

BORE: To cut a circular hole by the rotary motion of a cutting tool.

BOREHOLE: A hole cut with a drill, auger, or other tools for exploring in search of minerals or water.

BRINE: (1) Water saturated or strongly impregnated with salt. (2) A saturated solution of a soluble mineral in water.

BRINE FIELD: A section of land under which quantities of rock salt or natural brine of usable strength have been discovered and in which a producing well has been bored for raising the brine.

BRONZE: Any of the many alloys of copper and tin, with or without other elements.

BROWN COAL: A low quality coal, brown to brownish-black in color which commonly contains structures of the wood from which it was formed. It is high in moisture and low in heat value. It is intermediate between peat and bituminous coal.

BRUSH ORE: An iron ore in stalactitic forms resembling a brush.

BRUTE: A rough or unpolished gem.

BULLDOZER: A tractor with a large scoop in front for clearing debris and moving earth.

BUREAU OF MINES: An agency within the U.S. Department of the Interior concerned with conservation and utilization of mineral resources and with health and safety regulations in the mining industry.

C

CAGE: An elevator used to carry men and materials up and down in a mine shaft.

CABLE SPLICER: (1) A short piece of tubing or specially formed band of metal generally used without solder in joining ends of portable cables for mining equipment. (2) A man who splices cable.

CACHE: A place where provisions, ammunition, etc., are hidden by trappers or prospectors.

CALCITE: An essential constituent of limestone, chalk, and marble. Commonly known as limestone $CaCO_3$.

CAMEL BACK: A miner's term that applies to rock masses that tend to fall easily from a mine roof.

CANDLE-FOOT: A unit of illumination or light given by a British standard candle at a distance of 1 foot.

CARAT: (1) A unit employed in weighing diamonds and other gem stones equal to 200 milligrams (international metric carat). (2) Used to distinguish fineness of gold alloy. Pure gold is 24-carat. Goldsmiths' standard is 22-carat fine, that is, it contains 22 parts of gold, 1 part of copper, and 1 part of silver.

CARBIDE: (1) A commercial term for calcium carbide used in miners' lamps. (2) It refers to carbon with one or more metallic elements.

CARBON: A nonmetallic element occurring native in two crystal systems, as a diamond and as graphite. It is also found in coal, petroleum, asphalt, limestone, other carbonates, and in all organic compounds.

CARBON 14: A radioactive isotope of carbon having an atomic weight of 14. It is produced by collisions between neutrons and atmospheric nitrogen and is useful in determining the age of carbonaceous material younger than 30,000 years.

CARBON 14 DATING: A method of determining the age of an artifact by means of measuring the rate of radiation of the carbon 14 isotope present in all organic matter. Carbon 14 has a half-life of 5,568 years.

CARBON STEEL: Steel containing carbon up to about 2 percent.

CARCASS: The tension carrying part of a conveyor belt. It is comprised of multiple layers of fabric or cord and/or simple layers of cord or steel cable banded together with rubber.

CAR CLEANER: A laborer who cleans mine cars in which coal is transported by shoveling out the fine dust and dirt from the cars.

CAR CUTTER: A laborer who uncouples one or more loaded mine cars from a train and pushes them onto a rotary dumper.

CASING: Piping used to support the sides of a borehole. Special steel tubing welded or screwed together, and lowered into a borehole. Used to prevent the entry of loose rock, gas, or liquid into the borehole, or to prevent the loss of circulating liquid.

CASING SHOE: A steel sleeve threaded to fit and be coupled to the bottom end of a diamond-drill casing as a cutting head and protector when the casing is driven through overburden.

CAULKING: Making a joint tight or leakproof by forcing plastic material between parts that are not tightly fitted.

CAVE-IN: Collapse of walls or roof of a mine excavation.

CAVERN: A subterranean hollow; an underground chamber.

CEILING BOLTS: Long steel bolts screwed into the ceiling of a mine which helps the ceiling from caving in.

CEMENTATION: To fill cavities or plug a drill hole with cement or other material to stop loss of water or entrance of unwanted liquids, gas, or fragmented rock into a borehole.

CENTRIFUGAL FORCE: The outward force exerted as centripetal force competes with the inertia of a moving object.

CENTRIPETAL FORCE: The force that constrains a moving object to follow a curved path, against the inertia of the object.

CERAMIC: A class of inorganic nonmetallic products which are heated during their manufacture.

CHEMIST: A person skilled in making chemical examinations or investigations.

CHIPPINGS: Crushed stone fragments ranging from 1/8 to 1 inch in size.

C-HORIZON: A layer of material beneath the B-horizon with an indefinite lower limit. It is relatively unaffected by the influence of organisms, and it is assumed to be similar to the material from which at least a portion of the overlying material developed.

CHUTE: An inclined channel underground, or trough above ground, through which ore falls from a higher level to a lower level.

CLASTIC: Fragments of rock or of organic structures that have been moved individually from their places of origin.

CLAY: A fine-grained, natural, earthy material, plastic when moist but hard when baked or fired.

CLEAVAGE: A tendency in rocks to split along definite, parallel, or crystal planes characteristics of the mineral.

COAL: A black, or brownish-black, solid, combustible, carbonaceous rock, formed by partial to complete decomposition of vegetation without free access of air and under proper conditions of moisture, pressure, and temperature.

COBALT: A tough, lustrous, metal. Magnetic and nickel-white or silvery-gray in color. Similar to iron but harder.

COKE: Bituminous coal from which the volatile constituents have been driven off by heat without flame.

COMPOUND: A combination of two or more elements, ingredients, or parts.

CONCENTRATE: The product of concentration.

CONCENTRATING: Separating the waste materials from the minerals.

CONGLOMERATE: A rock composed of rounded fragments, varying from small pebbles to large boulders, in a cement of hardened clay or the like.

CONTOUR MINING: Strip mining around hills or mountains.

CONVEYOR: A mechanical apparatus for carrying material from one point to another, as by belt or chain.

COPPER: A common element, reddish in color and one of the best conductors of electricity and heat.

CORE: The sample of rock obtained through the use of a hollow drilling bit.

CORE DRILLING: The process of obtaining rock samples by using a hollow drilling bit.

CRANE: A machine for raising, transporting, and lowering heavy weights, commonly by means of a projecting swinging arm.

CROSSCUT: An underground passageway running at right angles to the main entry to connect it with a parallel entry or with an air course. In general, any drift driven across or between two main openings for a mining purpose.

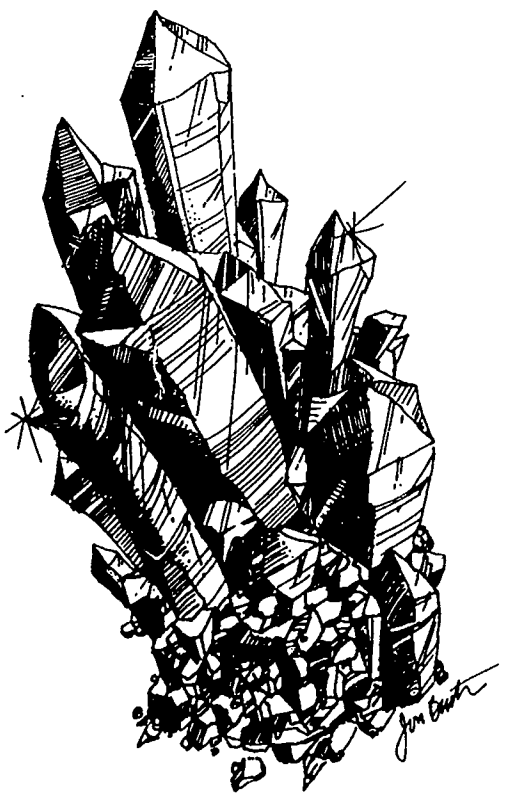
CRUSHER: Machinery designed to crush or pulverize rock or other materials. There are many types of crushers: Jaws, Stamps, Rollers, Rod, or Ball Crushers.

CRUSHING: The process of pulverizing ore by stamps, crushers, or rollers.

CRUST: (1) A hard layer on the surface of softer material. (2) The outer layer of the earth.

CRYSTAL: A regular polyhedral form, bounded by symmetrically arranged plane surfaces, formed by solidification of a chemical element or compound under favorable conditions.

CUT-AND-FILL STOPING: A method of removing ore from vertical veins in horizontal slices, starting at the bottom of the stope and advancing upward.



D

DAMP: Any gas occurring in mines, especially coal mines.

DEPOSIT: A natural occurrence or accumulation of mineral material, as iron ore, oil, or gas.

DEPUTY: An underground official in a mine who has the responsibility for the safe and proper working of the mine.

DERAILER: A safety device for derailing mine cars that is installed on grades to protect miners working below.

DERRICK: A framework placed over a borehole to support drilling tools or pipe, often used for hoisting and lowering drill rods and pipe.

DETONATE: To cause to explode by the sudden application of force.

DIAMOND-SCALE: An instrument used to weigh diamonds with the weight units calibrated in carats.

DIAMOND-TOOTH SAW: A circular saw for cutting stone where the points of the teeth are pieces of diamonds.

DIE CASTING: A process where molten metal is forced under high pressure into the cavity of a metal mold.

DIFFERENTIAL FLOTATION: Separating a complex ore into two or more valuable minerals and gangue by flotation. Also called selective flotation.

DIKE: A tabular body of igneous rock that flowed into a fissure when molten, usually at a steep angle, often resisting erosion and standing like a wall.

DILLY HOLE: A small sludge-catchment basin placed between the collar of the borehole and the main drill sump.

DIP: The angle at which an ore deposit is inclined from the horizontal.

DOME: (1) A mountain having a smoothly rounded summit of rock that resembles the cupola or dome on a building. (2) A subterranean structure which has a dome shape, i.e., salt dome.

DONKEY ENGINEER: The operator of a small engine powered by steam or compressed air in driving pumps or supplying water to boilers or operating a hoist.

DRAGLINE: A type of excavating equipment which casts a rope-hung bucket a distance and collects material by pulling the bucket toward itself on the ground with a second rope.

DRAWPOINT: A place where gravity-fed ore can be loaded into hauling containers or vehicles from a higher level.

DREDGE: A large, barge-like machine used in underwater excavation, such as for maintaining water depths in canals, rivers, and harbors.

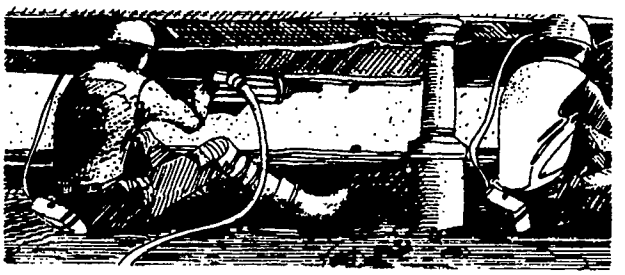
DREDGING: (1) The act of using a dredge. (2) The material brought up by a dredge.

DRIER: An oven used to remove water from damp molded ware by heating with forced circulation of air.

DRIFT: A horizontal underground passage that follows a vein of ore, as opposed to a crosscut, which crosses the vein.

DRILL: A cutting tool designed to form a circular hole in rock, metal, wood, or other material.

DRILLING: (1) The process of making a circular hole with a drill. (2) Making holes for prospecting or mining purposes.



DRIVE: To excavate horizontally or at an inclination, as in a drift or adit.

DUCK: A fabric material usually of woven cotton used in the construction of conveyor belts and filters.

DUCKFOOT: A pipe bend at the bottom of a shaft column with a horizontal base strong enough to support the rising main to rest upon it.

DUMP: Pile of non-ore (waste) material stacked at the entrance of a tunnel or at the collar of a shaft or open pit.

DUST CLOUD: Coal or other dust particles carried in suspension in the air.

DYNAMITE: An industrial explosive which is detonated by blasting caps. The principal explosive ingredient is usually nitroglycerin.

E

EBB TIDE: Referring to that period of tide between high water and low water, a falling tide.

ECHOGRAM: A graphic recording produced by sonic devices which shows ocean bottom profiles and delineates the bedding planes and dissimilar rock contacts to a depth of 1500 feet into the sediments.

ECONOMIC MINERAL: Any mineral having a commercial value.

EDDY: A circular movement of water formed where currents pass obstructions.

ELBOW: A fitting that makes an angle between adjacent pipes.

ELECTRIC SPONGE: An electric centrifugal pump designed to draw water if it is only 2 or 3 inches deep. It is placed in the water at the bottom of a shaft.

ELECTRODE: An electrical conductor for leading current into or out of a medium.

ELECTROLYSIS: (1) Chemical change resulting from the passage of an electric current through an electrolyte. (2) Process of transferring material from one point to another as with plating operations (see electroplating).

ELECTROPLATING: To plate with an adherent metal upon an object serving as a cathode by means of electrodepositing.

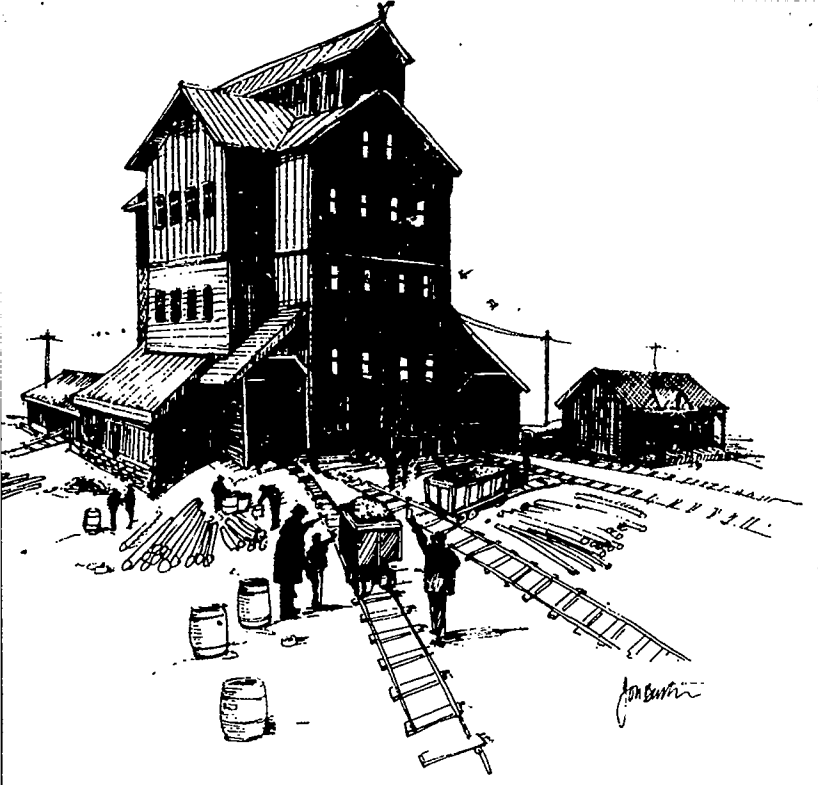
ELECTROPOLISHING: Polishing the surface of a metal by preferential dissolution of metal at the anode.

ELEMENT: A substance whose atoms all have the same atomic number. Generally thought of as a substance which cannot be decomposed into other substances except through natural radioactive decay or bombardment of high-speed particles.

EMBEDDED: Set solidly in a bed.

EMERALD: A variety of beryl - gem stone. The green color is due to a trace of chromium.

EROSION: All processes by which earthy matter or rock is loosened and moved from place to place. It includes processes of weathering, solution, corrosion, and transportation.



ESSENTIAL MINERAL: A mineral present in a rock that is required in its classification and naming.

EQUIPMENT: Tools and machinery used in a mining operation or for other work.

EXCAVATING: Digging and removing soil; blasting, breaking, and loading of coal, ore, or rock in mines.

EXFOLIATION: The phase of weathering where the rock breaks loose in thin concentric shells, slabs, spalls, or flakes from rock surfaces.

EXTRUSIVE: Igneous material poured out on the surface of the earth in a molten state and to all sizes of fragmental material erupted from volcanic vents.

EXHAUST FAN: A fan which sucks used air from a mine and causes fresh air to enter by separate passages.

EXPLORATION: The search for coal, mineral, or ore, as by geological surveys, prospecting, or use of tunnels, drifts or boreholes.

EXPLOSIVE: A substance which undergoes a rapid chemical change resulting in production of large volumes of gases and, if in a confined space, produces high pressures.

EXTRUSIVE ROCK: Igneous rock derived from magma that cooled after reaching the earth's surface.

F

FALL LINE: A line joining the waterfalls on a number of successive rivers that makes the point where each river descends from the upland to the lowland, like the edge of a plateau.

FATHOM: A measure used for sea depths and sometimes for shaft and rope lengths. A unit of linear measurement that equals 6 feet. In mining it equals 6 feet square by the thickness of the vein.

FAULT: A fracture in the earth's crust, with displacement of the two sides relative to one another and in a direction parallel to the fracture.

FAULT BLOCK: A body of rock bounded by one or more faults.

FELDSPAR: One of a group of rock-forming minerals. Mohs' hardness, 6; specific gravity 2.5 to 3. Important in glass and ceramic industries.

FILTER: (1) A device for separating solids or suspended particles from liquids or fine dust from air. (2) In ore treatment, a device with a separating membrane on which solids are retained.

FIRESTONE: Pyrite which was formerly used for striking fire.

FIRING: (1) The initiating action of an explosive charge or blasting action. (2) The act or process of applying fire or intense heat to anything such as stoking.

FISSURE: A crack or break in rocks. In mining, a crack of a few inches or a few feet is usually not thought of as a fissure unless it is extensive.

FLUSHING: A drilling method in which water or a mixture of water and clay is forced into a borehole to remove broken rock fragments.

FLINT: A massive, very hard kind of quartz which will spark when struck against steel.

FLOTATION: Separating ore from waste materials by floating away the materials of lower specific gravity, while the heavier materials sink.

FLUX: (1) A substance used to promote fusion of metals or minerals. (2) The rosin applied to surfaces to be joined by soldering, brazing, or welding to clean and free them of oxide and promote their union.

FOLD: A bend in rock or strata which has a planar structure.

FOOTWALL: The wall or zone of rock under an inclined vein. It is beneath the miners' feet as they excavate the ore.

FORGE: An open fireplace or hearth with forced air, for heating iron, etc., as a blacksmith's forge.

FORMATION: Any rock unit or series of bedded units conspicuously different from adjacent rock units.

FOSSIL: Any remains, impression, or trace of an animal or plant of past geologic ages that have been preserved in the earth's crust.

FOSSIL FUEL: Fuel from fossil deposits: coal, petroleum, and natural gas.

FRACTURE: (1) The character or appearance of a freshly broken surface of a rock. Helps in the identification of some minerals. (2) A break in a rock formation due to intense folding or faulting.

FRASCH PROCESS: A process used in mining sulfur in which superheated water is forced into the sulfur deposit for the purpose of melting the sulfur. The molten sulfur is then pumped to the surface.

G

GABBRO: A coarse-grained igneous rock composed of calcic plagioclase, pyroxene and olivine.

GALLERY: A horizontal underground passage either natural or manmade; also called a drift in mining.

GANGUE: Minerals associated with an ore deposit that are of no economic value. These minerals may be metalliferous or non-metallic.

GANGWAY: A passageway driven for exploration and development in coal mines; known as a drift in metal mines.

GAS: The term normally used by miners to designate any impure air, especially explosive combinations.

GASOLINE: A volatile, flammable, refined petroleum product, suitable for use as fuel, especially in internal combustion engines.

GEM: A precious or semiprecious stone cut and polished for ornament.

GEOCHEMISTRY: The study of the presence of elements and isotopes in the earth; their abundance and distribution.

GEODE: A hollow nodule, the cavity of which is commonly lined with inward pointing crystals of quartz.

GEOLOGIST: One who studies the materials, structure and history of the earth.

GEOLOGY: The science that deals with the study of the earth; its origin, composition, structure, history, and nature of processes resulting in its present state.

GEOPHYSICS: The study of the earth with respect to physical phenomenon relating to structure, composition, development, and history.

GIANT: The large nozzle of a pipe used to convey water for hydraulic mining.

GLASS: (1) An amorphous inorganic mixture formed by fusing (melting) non-metallic substances together, then rapid cooling to a rigid condition without forming crystals. (2) Substance produced by the quick cooling of an igneous magma (pumice).

GLORY HOLE: A funnel-shaped excavation that intersects the ground surface. It may have a raise or draw point at the bottom for underground haulage of ore.

GO-DEVIL: A special apparatus that is sent through a pipeline to clean it out. It maybe forced through by water, compressed air, or mechanically.

GOLD: A yellow metallic element. Precious metal used as a common commercial medium of exchange.

GOLD STANDARD: A monetary standard under which the basic unit of currency is defined by a stated quantity of gold.

GOLIATH CRANE: A large overhead beam-mounted crane having a lifting capacity of 50 tons or more.

GONDOLA: A flat bottom railroad car with no top that is used chiefly to haul steel, rock, or heavy bulk items.

GRADE: (1) The percentage of economically valuable mineral(s) in an ore deposit. (2) The slope of a traveling way, sluice, slope, etc.

GRANITE: A coarse-grained, light colored, igneous rock containing quartz, potassium, feldspar, mica, hornblende, and other accessory minerals.

GRAVEL: Grain-size measurement relating to sedimentary rocks. Particle size larger than coarse sand and smaller than pebbles. Usually from 2 to 4 mm.

GRINDING: Reducing material into fine particles by friction.

GROUND WATER: That water found underneath the surface of the earth. The water which permeates the earth's crust occupying spaces, fissures, and fractures.

GUN POWDER: An explosive mixture of potassium nitrate (saltpeter), sulfur, and charcoal, used in ammunition and blasting agents.

GUY: A rope or wire line that holds the top of a drill derrick or pole. It is anchored into the ground.

H

HANGING WALL: The wall or zone of rock above an inclined vein. It hangs above the miners as they excavate the ore.

HARD FIRED: Clay products which have been fired at high temperature to near vitrification.

HARDHAT: A term used for safety helmet. It has a hard crown and is worn by miners and others to resist blows against the head.

HARDNESS: Resistance of a mineral to scratching or cutting. For minerals, a measure on Mohs' scale according to the tendency to scratch or be scratched.

HARDNESS SCALE: The empirical scale by which the hardness of a mineral is determined as compared with a standard.

HEADMAN: One who works at the top of a haulage slope who attaches a cable to the cars for haulage along an incline.

HEAP SAMPLING: A method of collection from a large ore pile or bin to yield a representative sample for testing for mineral content.

HEAVY MINERALS: Minerals having a high specific gravity, such as gold, platinum, and tin.

HIGH-GRADE ORE: Ore having high concentrations of the metal for which it is mined.

HOIST: A lifting apparatus, as an elevator, a hydraulic lift, or a windlass.

HONE: A block of fine abrasive used for fine grinding.

HYDRAULIC MINING: Mining by washing away sand, salt or rock with a stream of high-pressure water, exposing the desired mineral(s), which may then be recovered by gravity separation or other processes.

HYDRAULIC: (1) Specifically having to do with water in motion, but the term is extended to include all fluids used to convey, store, or transfer pressure. (2) To move material by means of water. (3) Operated or affected by water, as a hydraulic press or ram.

HYDROLOGIST: One who studies the properties distribution and circulation of water on land surface in soil and underlying rocks, and in the atmosphere.

ICE FLOE: A flat free mass of floating sea ice.

ICE FOOT: A fringe of ice located along the land shore in polar regions.

IGNEOUS ROCK: Rock formed by the solidification of molten material that originated within the earth. May be intrusive or extrusive.

IMPACT TEST: A test to determine the behavior of materials when subject to forceful collision.

IMPERMEABLE: Having a texture that does not permit water to move through it under ordinary head pressure.

IMPURITIES: Undesirable elements or compounds in a material.

INCLINED PLANE: A plane surface that makes an oblique angle to the horizontal.

INDUSTRIAL MINERALS: Rocks and minerals having components with industrial usage. Includes metallic minerals such as gold, silver, and iron; and non-metallic substances such as barite, gypsum, sand and gravel, and building stone.

INERTIA: The tendency of an object to resist change in motion. An object at rest tends to stay at rest. An object in motion tends to continue in the same direction and at the same speed unless acted upon by an outside force.

INGOT: A mass of cast metal as it comes from the mold, such as a bar of gold or silver.

INSOLUBLE: Incapable of being dissolved in a liquid.

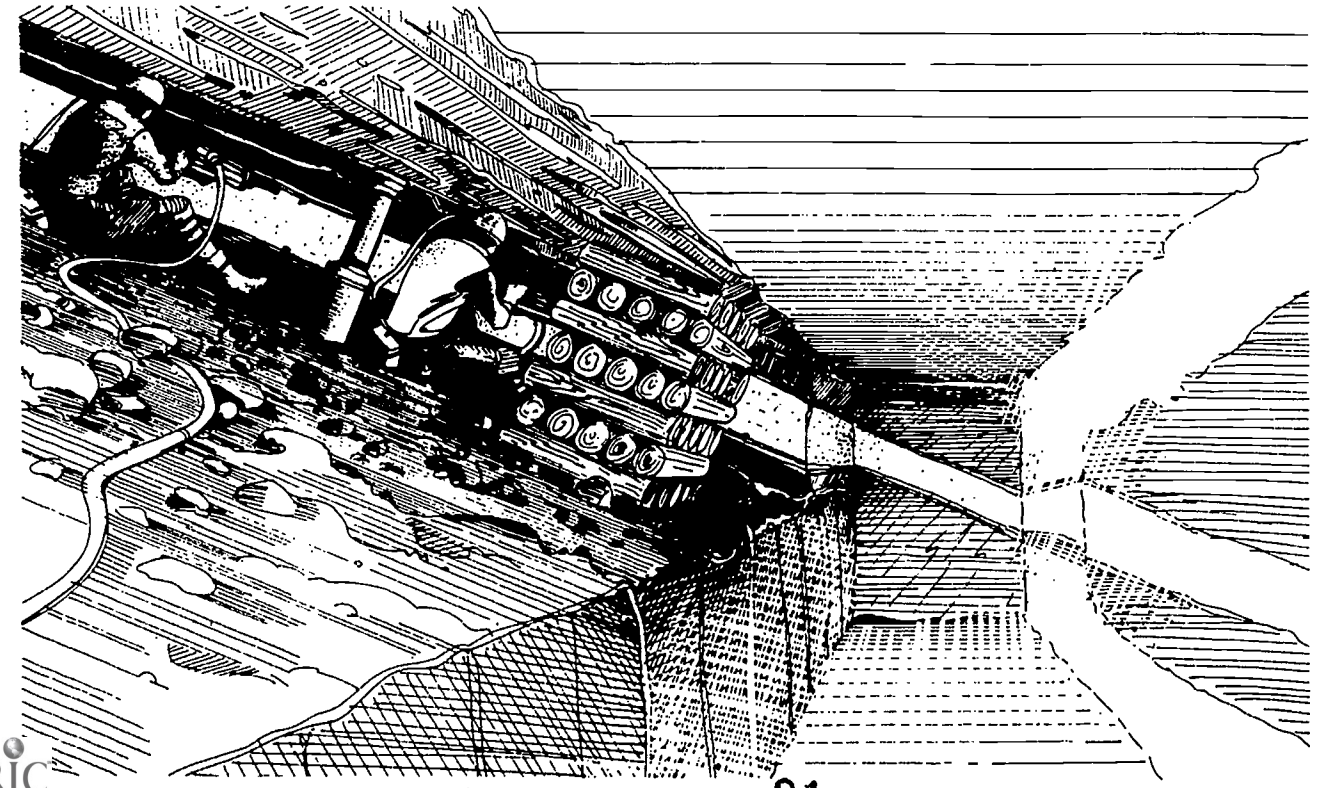
INSTRUMENT: (1) A tool. (2) In mining, a telescopic level, such as a transit.

INTRUSION: A mass of igneous rock which, while molten, was forced into or between other rocks.

INTRUSIVE ROCK: Rock formed from magma that solidified without reaching the earth's surface.

INVERSION: (1) A folding back of rock strata upon themselves as by the overturning of a fold in a manner by which their sequence seems reversed. (2) An increase of air temperature with increased elevation rather than a usual decrease.

IRON: (1) Heavy, malleable, ductile, magnetic silver-white metallic element. (2) The most used of metals and vital to biologic processes.

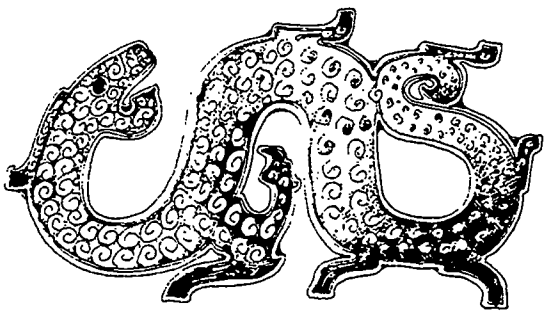


JK

JACKHAMMER: A percussive type of rock drill tool powered by compressed air.

JACKSHAFT: A supporting bar used with screwjacks to support a rock drill.

JADE: A hard, tough material of either pyroxene or amphibole family of minerals, greenish-white to deep green in color, used in making carved ornaments.



JEWEL: A precious stone, especially, a stone cut and polished for use as an ornament.

JUMPER: (1) A steel bar used in manual drilling or used to dress rock faces, pry off loose rock, etc. (2) One who jumps a claim, that is, takes possession of another's mining property.

KEROSENE: A flammable petroleum product that is less volatile than gasoline and is used for burning in lamps and heaters.

KETTLE: A barrel-shaped iron or wooden vessel used to raise men or materials in shaft sinking.

KETTLEMAN: One who refines lead in a series of oil-fired kettles or one who removes silver and copper from black mud in a gas-fired kettle, preparatory to the separation of gold.

KYLITE: A medium to coarse-grained gabbroic rock, intermediate in mineral composition between typical teschenite and picrite, containing less feldspar than the latter, but more than the former.

L

LABORER: (1) A man hired by the contract miner to assist him. (2) A person working for day wages in or about a mine.

LACING: The timber or other materials placed behind and around the main supports in a mine.

LADLE: The steel holding vessel, in a smelter or foundry, used in transferring or transporting of molten metal, matter, or slag.

LAG: To protect a shaft or level from falling rock by lining it with timber.

LANDSLIDE: The downward and often sudden movement of superficial deposits on hillside slopes. The movement is in response to gravity and may start due to an increase in weight such as water content, or the removal of support at the base by cutting into it.

LEACH: To dissolve metals or minerals out of ore by use of chemical solutions, acids, or water.

LEACHING: The action of percolating liquid in order to remove the soluble parts.

LEAD: A metallic element. The heaviest and softest of the common metals.

LEADER: A narrow vein branching upwards at an angle from a much larger vein.

LENS: A body of ore or rock thicker in the middle area and thinner at the edges.

LEVEL: Mine drifts and crosscuts made at one elevation in an underground mine. Miners usually develop several levels, each at a different depth, often connected by a shaft or series of ramps, to explore and develop the limits of an ore body.

LIFT: To lift from a lower level to a higher level or position.

LINING: The brick, concrete, cast iron, or steel casing placed around or inside of a tunnel or shaft as support.

LINK: A chain unit of a surveyor's chain being 7.92 inches long. It serves as a measure of length.

LITHOSPHERE: The solid part of the earth, as contrasted with the enveloping hydrosphere and atmosphere. Especially the earth's crust.

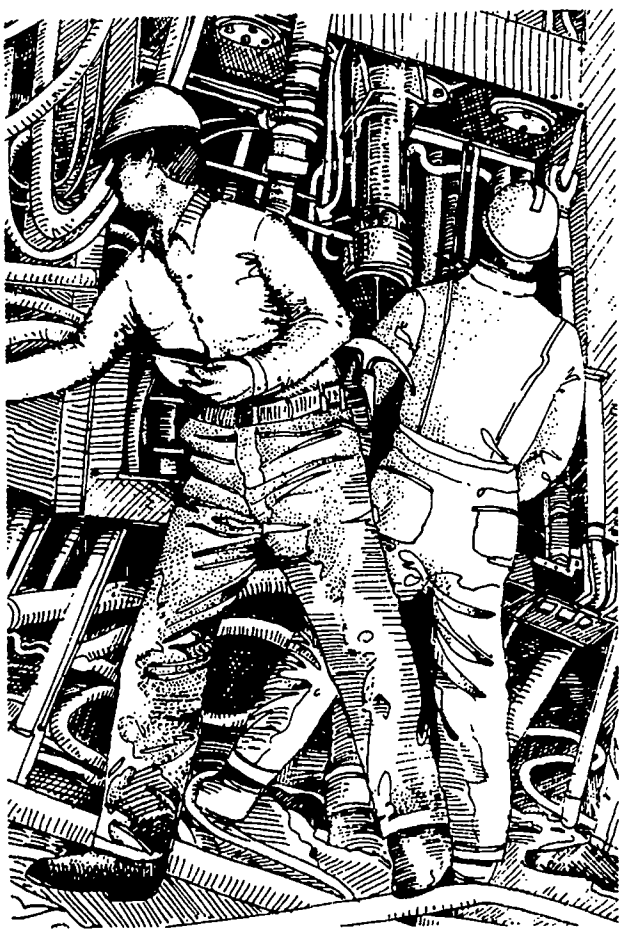
LITTLE GIANT: A joined iron nozzle used in hydraulic mining.

LOAD: (1) Unit of weight of ore used in South African diamond mines: equal to 1600 pounds or 0.8 short tons. (2) The act of placing an explosive in a borehole. (3) The amount of material that is transported at a given time by a stream, glacier, or wind.

LODE: (1) An ore deposit, usually referring to a vein or veins of ore that can be mined as a unit. (2) Tabular (table-like) deposit of a valuable mineral confined within definite boundaries.

LONGWALL MINING: Removing all coal or ore from horizontal continuous seams. Supports of stone and timber are built instead of leaving pillars of coal or other natural material.

LOW-GRADE ORE: Ore that is relatively poor in the metal or mineral for which it is mined.



M

MACHINE: A general term to refer to all types of equipment used in mines: drills, loaders, etc.

MACHINERY: The means and appliances by which anything is kept in action or a desired result is obtained.

MAGMA: Molten material within the earth from which igneous rocks are formed.

MAGNESIUM: A light, malleable, ductile, silvery-white metallic element abundant in nature, used in metallurgical and chemical processes and the manufacture of pyrotechnics. Pure magnesium gives off intense white light when burned.

MAGNETITE: A black iron oxide mineral present in iron ore.

MANDREL: A miner's pick or the shaft or bearing on which a tool is mounted.

MANGANESE: A hard, brittle metallic element, grayish-white to dark purple which resembles iron but is not magnetic.

MANTLE: (1) The layer of the earth between the crust and the core. (2) In mining, the soil or other material commonly referred to as overburden.

MECHANICS: The branch of physics that deals with the action of forces on materials.

MEDIAN DIAMETER: The diameter which marks the division of a given sample into two equal parts by weight, one part containing all grains larger than the diameter and the other part smaller.

METALLIC: Of metals or containing metals, especially the valuable metals that are the object of mining.

METALLOGENIC PROVINCE: A region in which a series of mineral deposits possess common characteristics.

METALLIFEROUS: Yielding or producing metals; as a metalliferous ore or deposit.

METALLURGICAL ENGINEER: One who applies engineering principles to the science and technology of metallurgy.

METALLURGIST: One who is knowledgeable in the science of metallurgy.

METALLURGY: (1) The science and technology of metals. (2) Process metallurgy is concerned with extracting metals from their ores, refining them, and preparing them for use. (3) Physical metallurgy has to do with the physical and mechanical properties of metals.

METAMORPHIC ROCK: Any rock which has been altered by heat or intense pressure, causing new minerals to be formed and new structures in the rock.

METHANE: The most common gas found in coal mines. It is tasteless, odorless, colorless, and highly flammable. The chemical formula is CH_4.

MICA: A family of colored or transparent mineral silicates crystallizing in monoclinic forms that readily separate into very thin leaves.

MICROMETER: An instrument for measuring very small dimensions or angles.

MILLING: The series of processes by which ore minerals are separated from the host rock and refined to a final marketable product.

MILL MAN: One who prepares clay for molding by grinding, mixing, and tempering it.

MINE: An opening or excavation in the earth for the purpose of extracting minerals.

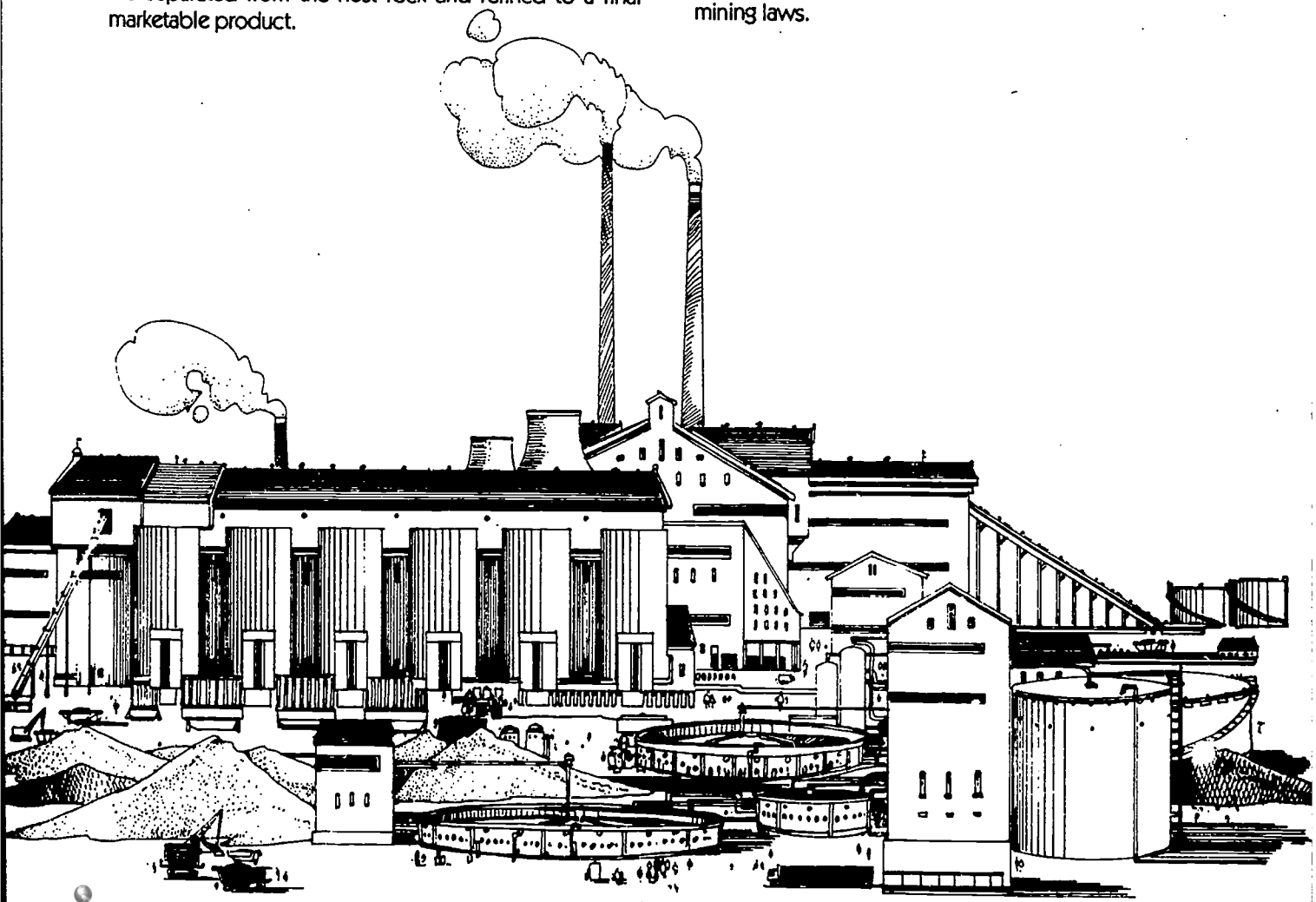
MINE INSPECTOR: One who checks mines to determine the safety condition of working areas, equipment, ventilation, and electricity, and also to detect fire and dust hazards.

MINER: (1) Any worker in a mine. (2) Technically, only those who have served an apprenticeship as helpers and those who are licensed by the state as miners.

MINERAL: A solid inorganic homogeneous crystalline substance resulting from the inorganic process of nature, with distinctive physical properties and definite chemical composition (or compositions). Also, any substance that is neither animal or vegetable.

MINEROGENETIC PROVINCE: A localized area in which mineralization has been active at one or more periods.

MINING CLAIM: That portion of the public land which a person may claim for mining purposes in accordance with mining laws.



MINING ENGINEER: A trained specialist in one or more of the branches of mining work, i.e., prospecting, surveying, sampling and valuation, technical underground management, milling, assaying, ventilation control, geological examination, and administration.

MINING: The science, technology, and business of mineral discovery, extraction, and marketing.

MIXTURE: A mix of two or more ingredients, each retaining its individual properties.

MOHS' SCALE: Empirical scale by which the hardness of a mineral is determined as compared with a standard, ranging from 1 (talc) through 10 (diamond).

MOLD: (1) An impression made in the earth or rock by the outside of a fossil shell or other organic form, or a cast of the inner surface of such a fossil. (2) A form into which ceramic clay, plastic, or other materials are poured or pressed to fabricate a desired shape.

MOTHER LODE: The principal lode or vein passing through a district or particular section of country.

MUCKING: Loading broken rock by hand or machine.

N

NAPPE: (1) A large body of rock that has moved forward more than 1 mile from its original position, either by overthrusting or by recumbent folding. (2) Faulted overturned folds.

NATIVE SALT: Natural halite or rock salt in its native state, as found and mined.

NATURAL GAS: A gas which comes from the earth's crust through natural openings or bored wells, often associated with petroleum. Methane is almost always the major constituent.

NATURAL RESOURCE: Materials supplied by nature, such as water, air, minerals, and trees.

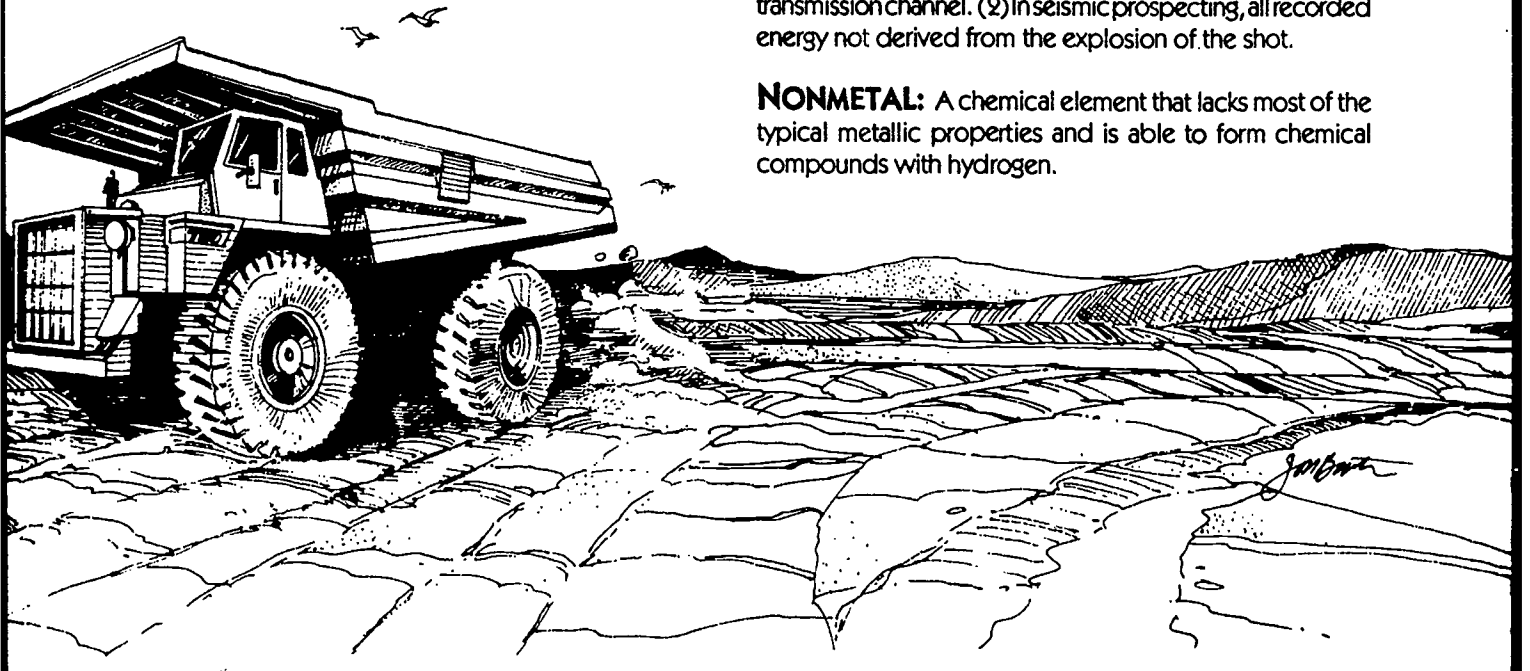
NATURAL VENTILATION: The movement of air in a mine as a result of a difference in density of the air that is brought about by natural causes and weather conditions.

NICKEL: A hard, malleable, silvery-white metallic element, resistant to corrosion, able to take a high polish, used mostly in alloys and as a catalyst.

NODULE: A small, more or less rounded body of mineral or mineral aggregate, generally somewhat harder than the surrounding sediment or rock material.

NOISE: (1) Any undesired sound or unwanted disturbance, such as undesired electric waves in a transmission channel. (2) In seismic prospecting, all recorded energy not derived from the explosion of the shot.

NONMETAL: A chemical element that lacks most of the typical metallic properties and is able to form chemical compounds with hydrogen.



O

OBSIDIAN: Volcanic glass. Usually black, but known also to be red, green, and brown.

OCCLUSION: (1) The trapping of a gas during solidification of a material. (2) The mechanical retention of gases in the pores of a solid.

OCTOPUS: A bin or tank to facilitate the concrete lining of circular shafts. The cement is fed through flexible rubber pipes to different points around the shaft to form a uniform lining without a joint.

OPAL: An amorphous, hydrous silicate mineral with conchoidal fractures which often displays a marked iridescent play of colors. A gemstone.

OPEN PIT: A mine or excavation open to the surface. Refers to mines of metal ores; distinguished from surface coal mines, which are commonly called strip mines.

OPEN-PIT MINING: Extracting minerals that lie near the surface.

ORE: A source of minerals that can be mined at a profit. Ore refers to either metallic or nonmetallic deposits such as sulfur.

ORE BODY: A mineral deposit that can be worked at a profit under existing economic conditions or: A solid and fairly continuous mass of ore that is individualized by form or character from adjoining country rock.

ORE CHUTE: An inclined passage for the transfer of ore to a lower level.

ORE PASS: A vertical or inclined passage through which ore is transferred downward. Usually equipped at the bottom with gates or other appliances for controlling the flow.

ORIENTATION: In surveying, the rotation of a map until its direction corresponds to direction in nature.

OUTCROP: The part of a rock formation that appears at the surface of the ground.

OVEN TENDER: One who loads and controls the temperature of an oven in which freshly painted parts are baked to harden their finish.

OVERBURDEN: The soil or rock that covers a mineral deposit.

P

PANMAN: One who is engaged in dismantling or building or operating underground trough conveyors for the transport of coal or other minerals.

PANNING: Washing earth or crushed rock in a pan, agitating with water, to obtain the particles of greatest specific gravity. Mainly practiced for gold, but also for diamonds and other precious gems.

PEAT: Formed in marshes and swamps from the dead and partly decomposed remains of the marsh vegetation. The material from which coal is eventually formed.

PENETRATION: The depth to which something penetrates. The consistency of a bituminous material expressed as that distance a standard needle vertically penetrates a sample under known conditions.

PENNYWEIGHT: One-twentieth troy ounce. Used for valuation of gold, silver, and jewels.

PERCOLATION: (1) A leach treatment of minerals whereby chemical solutions flow through a bed of ore dissolving the desired soluble materials. (2) The slow seepage of water through soils or porous deposits.

PERFORATOR: Tool designed to puncture a well casing at a depth to allow oil to be released and move into the well.

PETROLEUM: Material occurring naturally in the earth, composed predominantly of hydrocarbons. Such material may be in gaseous, liquid, or solid state, depending on the nature of the compounds and the conditions of temperature and pressure.

PILOT: A cylindrical steel bar extending through and beyond the face of a reaming bit. Acts as a guide that follows the original, unreamed part of the borehole.

PHYSICIST: One who is a specialist in physics or well-versed in the natural sciences.

PICK: (1) A heavy, pointed iron or steel tool, wielded by means of a wooden handle. (2) The steel cutting points on a coal-cutter chain.

PILLAR: An area of coal, rock or ore left to support the overlying strata or hanging-wall in a mine.

PLACER DEPOSIT: An alluvial marine or glacial deposit resulting from the crumbling and erosion of solid rocks, and often containing valuable minerals.

PLACER MINING: The extraction of minerals from a placer deposit.

PLASTIC: (1) Capable of being reformed, continuously and permanently, without rupture. (2) Synthetic or natural resins which can be molded by heat, pressure, or both.

POLLUTION: Impurities which defile or make unclean, especially in reference to defiling natural resources, such as air, water, or the landscape.

POROSITY: The rate expressed as a percent of volume of pore space in a sample of rock or soil.

POTASH: Originally referred to as potassium carbonate recovered from wood ashes, but often used now in reference to material containing the potassium or potassium compounds.

POTENTIAL ORE: Ore that is presumed to exist, but not proven.

PRECIPITATION: (1) The process of separating mineral constituents from a solution by evaporation. (2) Discharge of solid or liquid water out of the atmosphere onto a land or water surface, i.e., rain or snow.

PRESS: A machine in which materials are subjected to pressure and thereby bent or molded.

PRESSURE CHAMBER: A method of driving tunnels and sinking shafts through running sand by holding back loose material by compressed air.

PRODUCTS: Marketable materials, metals, or commodities resulting from mining and milling of ores.

PROSPECT: (1) A mineral property, the value of which has not been proven. (2) To search for minerals or oil.

PROSPECTOR: A person engaged in exploring for, or in testing discoveries of, valuable minerals.

PUMICE: A highly porous igneous glass, usually containing 65 to 75 percent SiO_2 and 10 to 20 percent Al_2O_3. Insoluble in water and not attacked by acids. Very light weight and will float on water.

PUMP STATION: The site at which one or more pumps are installed along a pipeline to force fluid through the line.

PUMP: A machine used to force fluids, such as water, gas, or slurry to flow, usually within a pipeline.

PUMPING: Raising or transferring a liquid or gas by means of a pump.

Q

QUARRY: An open excavation, usually for obtaining building stone, slate, or limestone.

QUARRYING: A way of mining a deposit that lies at the surface of the earth with little or no overburden.

QUARTZ: Crystallized silicon dioxide (SiO_2). Quartz can be found as mineral crystals in rock cavities and as discreet crystals in rocks like granite and sandstone. Quartz can be various colors and is extremely hard and durable.

QUICKSAND: A sand saturated with water that has no bearing capacity. It is shifting, easily moveable, or semiliquid.

QUICKSILVER: A common name for mercury. An amalgam of quicksilver and tin is used in making mirrors.

R

RADIATION: Radiant energy, emitted in the form of waves or particles. A hazard in uranium mines.

RAISE: A passage driven upward from a lower level toward an upper level in an underground mine.

RAMP: An inclined underground opening that connects levels or production areas.

RATHOLE: A shallow auxiliary hole alongside a main borehole in which the rod for the top of the drill column is stored when not in use.

RECLAIM: To restore to original or near-original condition.

RECLAMATION: On completion of mining, the law now requires that the land disturbed by mining be returned to near-original condition. Requires clean up of ponds, dumps, and roads. Land must be revegetated and land contoured to match existing topographic slopes in the area.

REFINERY: A plant in which metal or valuable mineral is extracted from ore.

REGOLITH: The layer or mantle of loose, incoherent rock material, of whatever origin, that forms nearly everywhere on the surface of the land and rests on the hard rocks or bed rock.

RESCUE TEAM: A team of men, from five to eight strong, trained in the use of breathing apparatus and in rescue operations. They are called to action in case of fire, explosion, or cave-in.

RESEARCH: A studious inquiry, examination, investigation, or experimentation aimed at the discovery and interpretation of facts, accepted theories or laws in the light of new facts, practical application, or revision of accepted theories or laws.

RESTORATION: To restore to original condition, as in restoring the earth's surface after closing an open pit or other surface mining operation.

RETURN TUNNEL: A tunnel or adit used as a return airway.

RHYOLITE: Any of a group of fine-grained extrusive igneous rocks having a similar chemical composition to granite, commonly occurring as lava flows, though occasionally as minor intrusions.

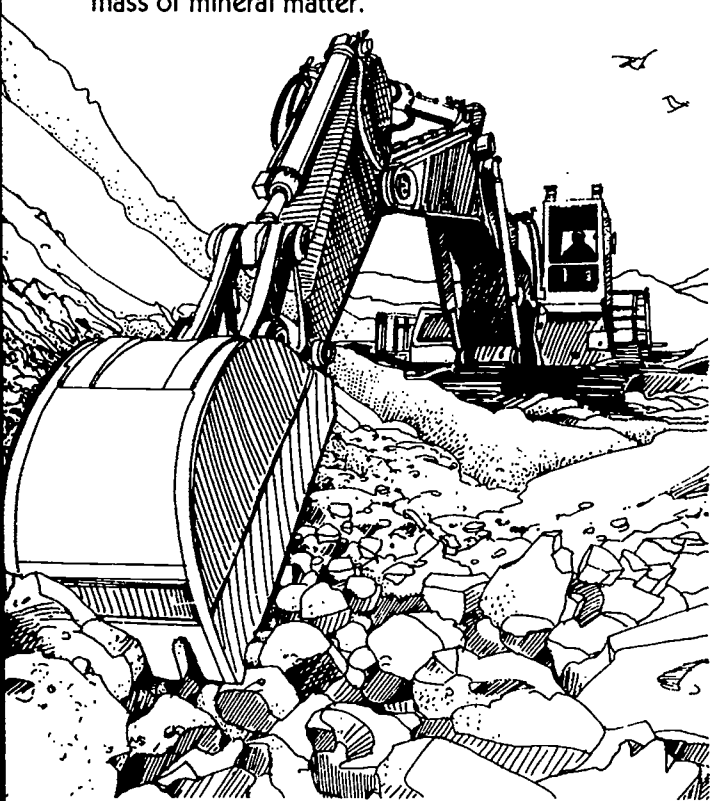
RIFLE: A borehole that follows a corkscrew course, or a drill core that has spiral grooves on its outside surface.

RIG: (1) A general term denoting any machine. (2) A drill machine complete with auxiliary and accessory equipment needed to drill boreholes.

RIPPERS: (1) A miner who breaks down the roof of a gate road to increase headroom. (2) An accessory drawn by a tractor or dozer to loosen compacted soils and soft rocks. It has long, angled teeth, reaching to a depth of 2 feet or more.

ROCK FORMATION: A part of the earth's crust that is more or less distinct from other parts. To quite an extent, an arbitrary unit.

ROCK: Any hard, consolidated, naturally-formed mass of mineral matter.



ROOM-AND PILLAR MINING: A method of mining coal or ore in which the roof is supported by pillars left at regular intervals.

ROTARY BUCKET: An auger-like device, up to 8 feet in diameter, with cutting teeth on the bottom end. It is used to drill broad, shallow holes for obtaining samples of soil.

ROTARY DRILL: A drill machine that rotates a rigid, tubular string of rods to which is attached a bit for cutting rock to produce boreholes.

S

SALT: (1) To introduce amounts of a foreign mineral into a sample, such as a sludge sample to be assayed, sometimes with fraudulent intent. (2) The general term applied to any one of a class of similar compounds formed when hydrogen is partly or wholly replaced by a metal or metallic radical. (3) The specific chemical, sodium chloride.

SAMPLE: A representative fraction of material, removed by approved methods and guarded against accidental or fraudulent alteration.

SAND: Separate grains or particles of rock material, easily distinguishable by the unaided eye, but too small to be called pebbles. Usually categorized by particle size ranging from .06 to 2 millimeters.

SANDBLASTING: A method of cleaning metal and stone surfaces with sand sprayed over them through a nozzle at high velocity.

SCREE: Long trails of loose rock that slope beneath steep mountain sides.

SCREENING: The separation of solid materials of different sizes, by causing larger components to remain on top of a perforated surface, while smaller components drop through to a lower level, possibly onto another perforated surface for finer screening.

SEALING: Used to overcome mine fires when other methods fail. It involves the erection of seals to cut off the oxygen supply to the area of the fire.

SEAM: A stratum or bed of coal or other mineral; generally applied to large deposits of coal.

SEDIMENTARY ROCK: Rock formed by the accumulation of sediment in water or from air.

SEMILOOSE: Used to include rock which is partially detached from a solid wall or outcrop and which rings as solid when struck, but which parts from the solid wall by apparent shear cracks or fractures.

SEPARATOR: A machine for separating, with the aid of water or air, materials of different specific gravity.

SEXTANT: A surveying instrument, hand-held, which measures angles between distant objects up to 120 degrees in any plane.

SHAFT: A narrow, deep excavation used for finding or mining ore or coal. The term is often applied to vertical shafts, as distinguished from a decline or inclined shaft.

SHEET MINERALS: Those minerals belonging to the phyllosilicate family having a mineral fabric whereby the material breaks into thin sheets, flakes, or "books." Includes mica and most of the clay minerals.

SHOCK WAVE: A wave sent out through the air or along the ground surface by initiating an explosion. This wave travels with the velocity of sound and produces the noise like the boom of a cannon.

SHOT: In mining, an explosive charge placed and detonated for the purpose of fracturing rock.

SHOVEL: A long-handled, scoop-like implement used to lift and throw earth, coal, etc.

SILICOSIS: Lung disease caused by inhaling silica-rich rock dust for a long period of time.

SILT: The fine sedimentary rock with particle size from .008 to .06 millimeters.

SILVER: A white metallic element, malleable and capable of a high degree of polish. Resists corrosion and has the highest heat and electrical conductivity of any substance.

SKIP: A high-speed elevator that carries ore to the surface.

SLOPE: (1) An inclined passage within a mine. (2) The inclination of a mine roadway or coal seam.

SLUICEBOXES: Long, shallow troughs with riffles in the bottom that provide a lodging place for heavy minerals in ore concentration. The material to be concentrated is carried down the trough in a current of water.

SLURRY: (1) Any finely divided solid which has settled out, as from washeries. (2) A mixture of cement and water pumped into a borehole or oil well to support the casing and prevent movement of underground fluids.

SMELTING: A heat process applied to ore, which separates a metal from impurities.

SMUT: A thin band of soft, inferior coal.

SOLID: (1) Any three-dimensional object. (2) Coal that has not been prepared for blasting. (3) A rock having few open cracks, crevices, or joints.

SOLIDIFICATION: The process of changing from a gas or liquid to a solid.

SONAR: Equipment for determining, by underwater sound, the presence, location, or nature of objects in the sea.

SPALLING: (1) Breaking or flaking off of rock, mineral, or metal from its surface. (2) To break up or reduce by chipping with a hammer.

SPOIL: The overburden or non-ore material removed from above the ore zone in surface mining.

STOPE: (1) An excavation from which ore has been excavated in a series of steps. (2) A cavern, chamber, or room from which ore has been extracted.

STALL: A working place in a mine, varying in length from a few feet to 80 yards or more.

STONE: Consolidated rock, small or large.

STOPING: Excavating ore, either above or below a level, in a series of steps. Exploratory and development openings are driven first to determine the limits of an ore body. The ore may then be removed by stoping above, below, or between levels.

STRATA: (1) Sedimentary rock layers. (2) Layers, either natural or artificial. Singular=stratum.

STRIKE: (1) The course or bearing of the outcrop of an inclined bed, structure, or ore body. (2) To find a vein of ore; a valuable discovery.

STRIP MINE: An opencut mine in which the overburden is removed from a coalbed before the coal is taken out.

STRIP MINING: The mining of coal by surface mining methods, as distinguished from the mining of metal ores by surface methods, which is commonly called open-pit mining.

STRIPPING: The process of removing the overburden from a mineral deposit or quarry.

SUBLEVEL CAVING: A stoping method in which relatively thin blocks of ore are caused to cave by successively undermining small panels.

SUBLEVEL: An intermediate level opened a short distance below the main level.

SUBLIMATE: A solid deposited by a gas or vapor.

SUBSOIL: The soil layer which lies beneath the true soil and which contains almost no organic matter.

SUMP: Any excavation in a mine for collecting or storing water.

SUPPORTS: Materials placed in stopes to arrest or regulate the closure of the walls; also called stulls, timber sets, steel sets, etc.

SURFACE MINE: Mining at or near the surface, usually done where the overburden can be economically removed. See also "Strip Mining" and "Open Pit."

SURVEYING: Determining the area topography, or geographic location of any portion of the earth's surface by taking linear and angular measurements and by applying the principles of geometry and trigonometry.

SURVEYOR: One who surveys land.

T

TACHOMETER: An instrument for measuring the speed of rotation, measured usually in revolutions per minute (RPM).

TACK COAT: A thin coat of hot road tar applied over a road surface to improve adhesion with the final surfacing.

TAILINGS: The waste material left over after mining and milling processes have been completed.

TARE: The difference between gross and net weight; the weight of a mine car when empty.

TEMPER: Reheating hardened steel for the purpose of decreasing hardness and increasing the toughness.

TEST HOLE: A drill hole or shallow excavation for testing an ore body.

TIN: A soft, faintly bluish-white metallic element, malleable at ordinary temperatures but brittle when hot; resists corrosion and is used as a protective coating for iron and copper. Also used in solder, bronze, and other alloys.

TOPSOIL: The surface portion of the soil including the A-horizon, usually only a few inches in depth.

TRADE: The business of buying and selling of commodities.

TRAMROAD: A mine haulage road.

TRANSLUCENT: Partly transparent; will admit and diffuse light so that objects beyond cannot be clearly distinguished.

TRANSPORT: A mining term used in reference to vehicular transport, hydraulic transport, and conveyors.

TRAP: That part of any mass of porous permeable rock which is sealed in top and down the sides by nonporous and impermeable rock.

TRAVELER: A truck rolling along a suspended rope for supporting a load to be transported.

TRESTLE: A bridge of timber or steel that has a number of closely spaced supports between the abutments.

TROY OUNCE: One-twelfth of a troy pound, which is 20 pennyweights or 31.1035 grams.

TUNNEL: A horizontal underground passage that opens to the surface at both ends.

UVWZ

URANIUM: A radioactive, silvery-white metallic element.

VARIOLITE: A fine-grained, formerly glassy volcanic rock, containing small, somewhat spherical bodies (varioles) consisting of minute radiating fibers of feldspar.

VEIN: A mineral deposit with definite boundaries that separate it from the surrounding rock.

VENTILATE: To provide with a for incoming fresh air, or an escape for gas, stale air, etc.

VIBRATING CONVEYOR: A trough or tube flexibly supported and vibrated at relatively high frequency and small amplitude to convey bulk material or objects.

NOTE: The terms and definitions listed in this mining glossary are not intended to be a comprehensive list. As you use this glossary, you may know of or come across other important mining related terms. Please use this space to include those terms and definitions.

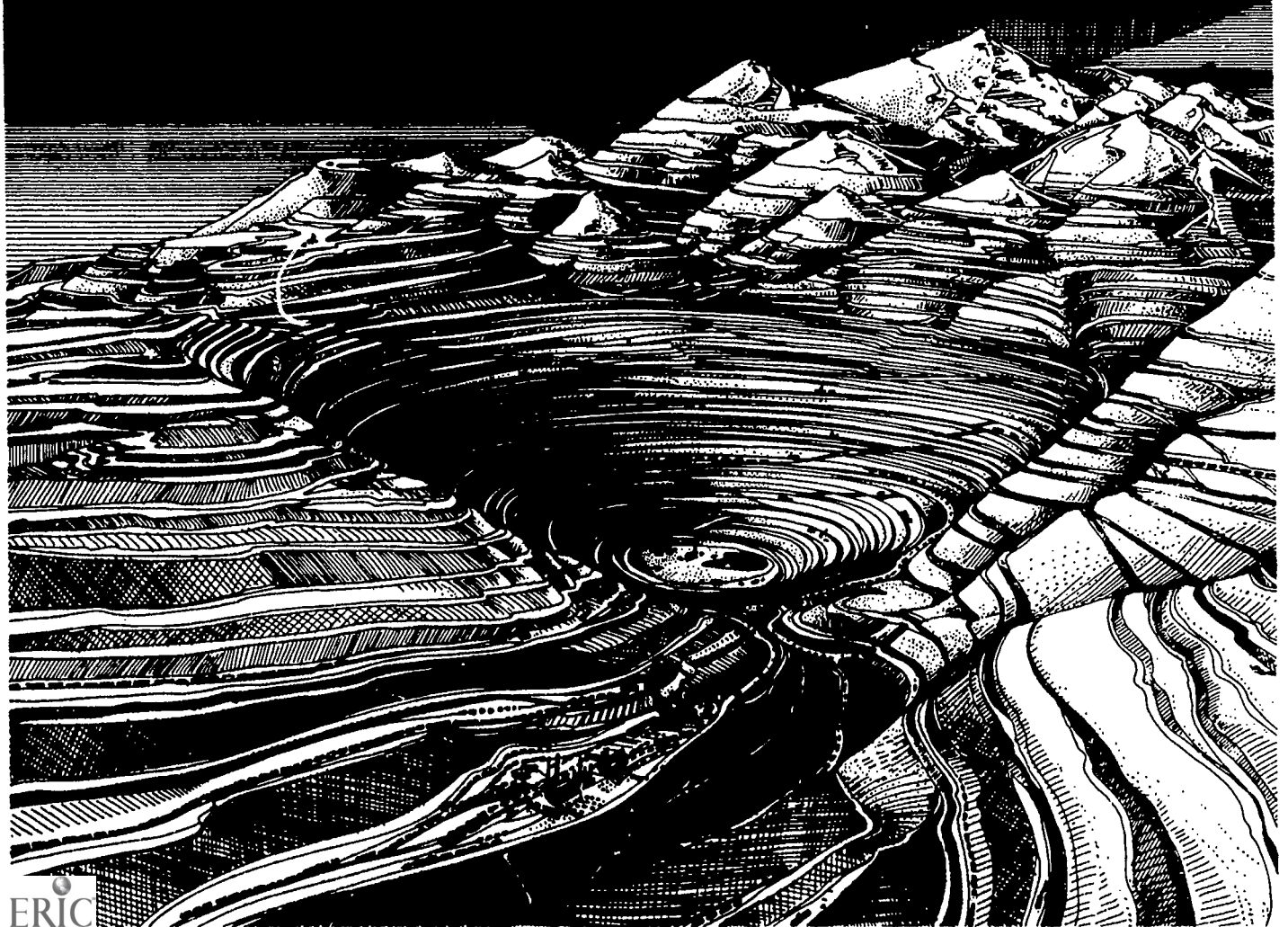
WASHERY: A place at which ore, coal, or crushed stone is freed from impurities or dust by washing.

WINZE: A passage driven downward from one level to another in an underground mine. In construction it differs from a raise only in that the winze is excavated downward and the raise is excavated upward. When completed, it is called a winze if one is at the upper level looking down, and a raise if one is on the lower level looking up.

WORLD QUAKE: An earthquake seismographically registered all over the world.

ZINC: A lustrous, bluish-white metallic element. Brittle at ordinary temperatures; malleable at temperatures 100 to 150 degrees Celsius. Used in many alloys, including brass, bronze, nickel-silver, bearing metal, and soft solder.

MINING GAMES



MINING GAMES

TO THE TEACHER

These **MINING GAMES** are designed to help students at all grade levels learn many language arts skills, including spelling, vocabulary development, word usage, pronunciation and the meanings of words that might be used in various related study units. The **MINING GAMES** are also designed to familiarize students with the **MINING GLOSSARY.** Many of the games are familiar to students and can be easily adapted for classroom use for any age group. Most of the games require minimal teacher preparation and can be completed in a short period of time.

There are many ways to use the games. Here are a few suggestions:

1. For vocabulary development for a specific topic or unit of study;
2. As an introduction to a unit on mining;
3. As learning activities within a unit on mining or any related topic;
4. As a review following instruction on mining;
5. As a way of motivating students to become familiar with the glossary.

It is important to note that the **MINING GAMES** can be easily adapted for any mining-related subject. Simply substitute the words in the games with other appropriate words found in the glossary that relate to the topic your students are studying.

All activities (except word-search activities) are designed with the same format, beginning with a title, a list of "Materials Needed," and "Procedure." This information is for students and should be adequate for them to work quite independently on the activity, assuming they have access to the materials listed. Following the section "Procedure," is a section called "Teacher Information," including the "Object of the Game" (a nutshell statement to remind the teacher what the activity is about), and "Prior Preparation," explaining materials that need to be prepared beforehand, so they are ready for student use. Where needed, sample questions, complete with answers, are provided in this section. To implement the activity, make a copy of the activity from title through Procedure. That information and the materials should be made available to students.

It is suggested that you keep a list of the mining terms students have studied, adding to the list as new words are learned. Some of the games work out best if students are already familiar with the terms involved. Terms for such games can be drawn from the list of terms students have already studied.

Following the Crossword Puzzle activities is an activity which explains how to prepare crossword puzzles, called "Make Your Own Crossword Puzzles." This activity will help the teacher in preparing additional crossword puzzles, but suggests that you also consider letting students prepare crossword puzzles for use by other students, friends and family. Awareness of the terms involved will be greatly enhanced as students prepare additional puzzles and write definitions for words selected. Learning benefits will likely be even greater in making the activity than in doing it as a game.

Word search activities can also be prepared by students after completing those provided herein.

ACKNOWLEDGEMENT
The National Energy Foundation acknowledges and appreciates the numerous educators who assisted in providing games and activities for this publication.

SUBJECT AND PREDICATE MIX/MATCH

Materials Needed:
Two sets of 3 X 5 cards (2 different colors) one with subject phrases and the other with predicate phrases written on them.
Mining Glossary

Procedure:
1. Each participant receives one card with either a subject phrase or a predicate phrase. Be sure that if a sentence is used, both parts are used in order that everyone will be able to find his/her match.
2. Each student now compares his/her card with those of others until a phrase that will complete the sentence is found. It is possible that more than one matching phrase exists for a given person. One is sufficient.
3. The Mining Glossary should be made available.

TEACHER INFORMATION

Object of the Game:
Each participant is to locate the person with the phrase that will complete his/her sentence. This game is a good "ice-breaker" activity, to encourage people to move around and get acquainted.

Prior Preparation:
1. Prepare a set of short, simple sentences which use mining terms and which have one subject phrase and one predicate phrase. You need at least half as many sentences as players. Keep in mind the reading level of the participants when formulating the sentence.
   Example: Many miners work underground.
2. For each sentence, write the subject phrase on one card and the predicate phrase on a second card (different color).

Sample sentences:

Subject Phrase	Predicate Phrase
Many miners	work underground.
Open pit mines	sometimes leave unsightly landscapes.
Mining machines	make the miner's job easier.
An alloy	is a mixture of metals.
Copper	conducts heat and electricity.
A hollow drilling bit	is used for core drilling.
A horizontal mine passage	is called a drift.
Flint	strikes a spark with steel.
One type of fossil fuel	is coal.
Impressions of prehistoric life	are called fossils.
Gangue	is waste material in a mineral deposit.
Igneous rock	forms from magma.
Methane	is a gas frequently found in coal mines.
The Assay	tells the percent of metal in ore.
A prospector	will explore for valuable minerals.

DRAWING RELAY

Materials Needed:
Several sheets of paper and one pencil for each team.
Word bank

Procedure:

1. Assign one person in the class to be the word banker. This person is in charge of the "word bank," and gives words to the teams when they are ready, one by one and in the same order for all teams. Words are not written or given on paper, but only shown.
2. The persons in each team are numbered.
3. Person number one from each team goes to the word banker where they are shown the first word, then each returns to his/her group and without saying anything, draws the item on the paper. The drawer continues to draw until someone in the team thinks they know the word. That person says the word very quietly to person number one.
4. If it is correct, person number two from that team goes to the word banker, quietly tells the word banker what the first word was, and the word banker will give that person the second word for his/her team.
5. The person with the new word returns to the group and draws the second word.
6. This process continues until the list is depleted, everyone in the team has had a chance to draw, or time is called.

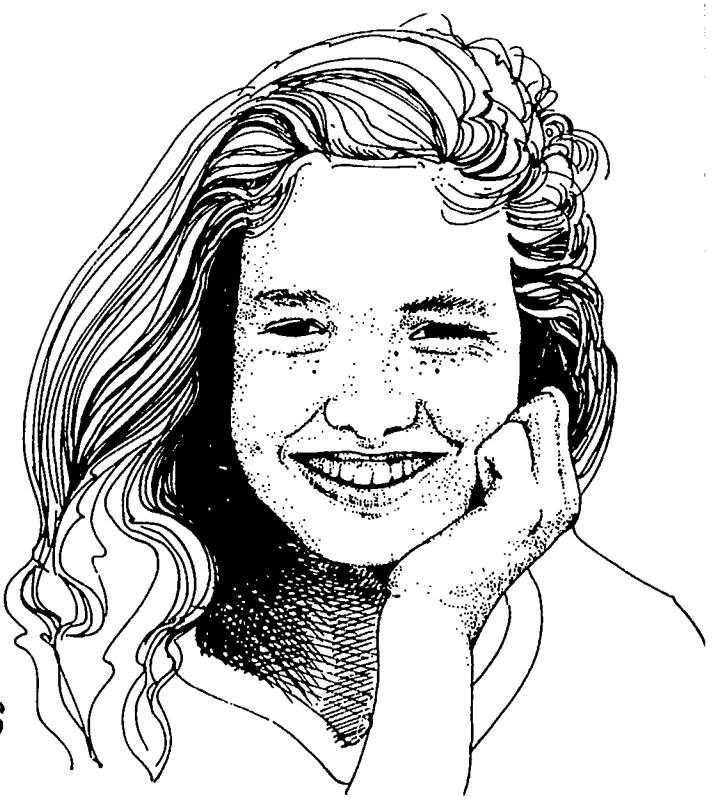
TEACHER INFORMATION

Object of the Game:
In teams, person number one of each group draws a specified item until a team member identifies the word represented by the item. A new word is then received by person number two and the process is repeated until all members of the team have had a turn to draw or until time is called.
When finished with the game, discuss each of the terms used, what it means, how it relates to mining, etc.

Prior Preparation:
1. Arrange the students in groups of 4-6 (but equal-sized groups), either at tables or on the floor in circles. Spread the groups a few feet apart if possible.
2. Prepare a list of mining terms for students to attempt to draw. This list will be the "word bank." Here are a few examples; more can be obtained from the Glossary.

coal	**crystal**
dynamite	**bit**
ingot	**rock**

3. Provide each group with several sheets of paper and a pencil.



MINING HANGMAN

Materials Needed:
Paper and pencil or chalkboard and chalk for each pair of students.

Procedure:
1. Students work in pairs. One person is to be the speller and the other is the checker.
2. Each pair of students gets paper and pencil (or chalk and an assigned position at the chalkboard).
3. The checker then selects, or is given by the teacher, a mystery word to be spelled, such as "shaft."
4. The checker draws a series of blank lines, one for each letter of the word, like this:

_____

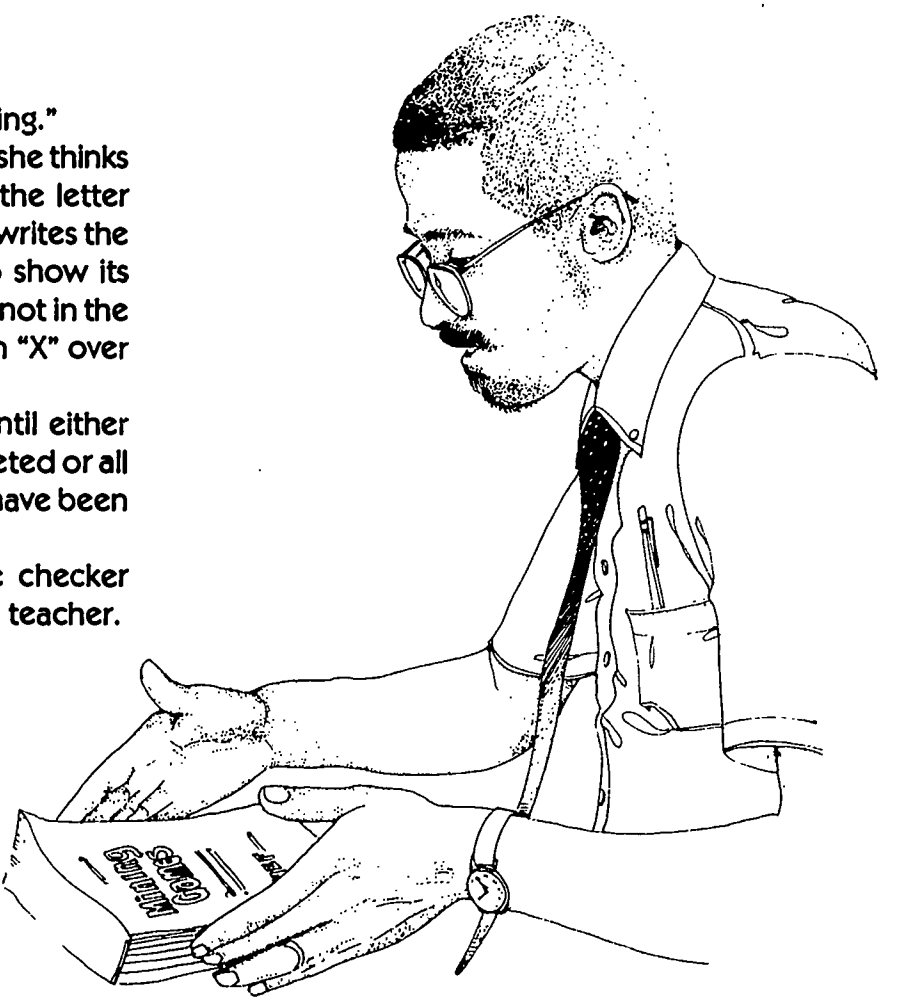
5. The checker writes the word "mining."
6. The speller guesses a letter that he/she thinks might be in the mystery word. If the letter appears in the word, the checker writes the letter in the appropriate blank to show its position(s). If the letter guessed is not in the mystery word, the checker puts an "X" over the "M" in "mining."
7. The game continues in this way until either the mystery word has been completed or all of the letters in the word "mining" have been crossed out.
8. Students exchange roles and the checker gets a new mystery word from the teacher.

TEACHER INFORMATION

Object of the Game:
This game is played like hangman, but instead of drawing the gallows step by step, the number of errors is determined by the number of letters in the word "mining," or other word selected.

Prior Preparation:
Prepare a word list from which students select words to use in the game. Here are some examples; others can be obtained from the glossary.

drill	**iron**
metal	**mineral**
geologist	**hardness**
shaft	**smelting**



USE YOUR NAME!

Materials Needed:
Paper and pencil

Procedure:
1. Select a category related to mining, such as mining processes or rocks and minerals.
2. Using the letters of your own name (first, last, both, or middle), find words that relate to the selected category and which begin with the letters of your name.

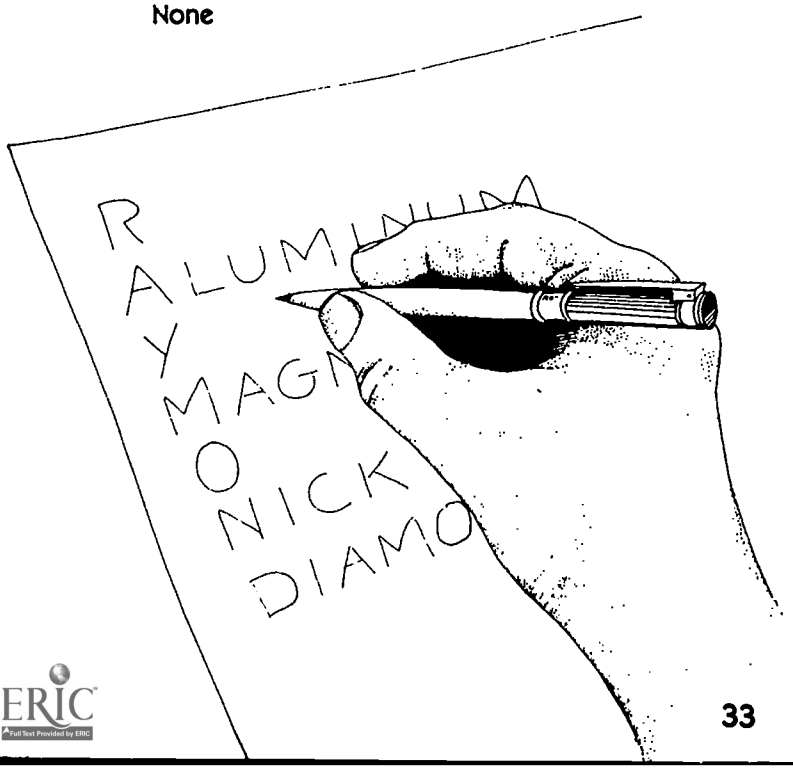
Example: (category -- rocks & minerals)

M	**agma**
A	**ndesite**
R	**ock**
V	**ariolite**

TEACHER INFORMATION

Object of the Game:
Get acquainted with new words and with the use of the glossary. Enhance awareness of mining terms.

Prior Preparation:
None



MINING WORD SCRAMBLE

Materials Needed:
Paper and pencil
List of scrambled words

Procedure:
1. Unscramble the scrambled letters to make words that are related to mining.
2. Look up each word in the glossary after you unscramble it, and be sure you know the meaning of the word.
3. Find some new words from the mining glossary. Scramble the letters and exchange scrambled words with a friend. Then challenge each other to give the meanings of the words.

TEACHER INFORMATION

Object of the Game:
Get acquainted with new words and with the use of the glossary. Enhance awareness of mining terms. When students are finished with the activity, discuss the meanings of the words used and challenge them to find each word in at least one new source other than the mining glossary.

Prior Preparation:
Select some mining terms and scramble the letters. Here are a few examples with the letters scrambled; others can easily be selected from the glossary and scrambled.

sitmhec	**chemist**
miginn	**mining**
mraotfoin	**formation**
fasht	**shaft**
olac	**coal**
roectorspp	**prospector**
siivnertu kroc	**intrusive rock**
msitgnle	**smelting**

MINING FICTIONARY

Materials Needed:
Paper and pencil
Mining Glossary

Procedure:
1. Divide the group into two teams -- Team A and Team B.
2. Each team selects a word from the glossary and writes the correct meaning and five phony meanings for the word.
3. Exchange words.
4. Considering the word and list of definitions received from the other team, each person on each team votes for the meaning that he/she thinks is the correct meaning.
5. Each team gets one point for each correct definition selected by their team and one point for each incorrect definition selected by the other team.
6. Each team now selects a new word, writes a new set of definitions, and the teams exchange again.
7. After a pre-determined number of exchanges, the team with the most points wins the game.

TEACHER INFORMATION

Object of the Game:
To recognize the correct meaning of a word when given a list of one correct meaning and several incorrect meanings.

Prior Preparation:
Have students practice making up phony, but logical-sounding meanings for words.

20 QUESTIONS

Materials Needed:
Word list

Procedure:
1. Select a leader.
2. If the leader does not already have the word list, he/she should get it from the teacher. No one else is to see the list.
3. The leader selects a word from the list and gives a clue to the word. Clues could be similar to the following, or the leader could use a different clue he/she thinks of.
   a. "I'm thinking of a word that begins with R."
   b. "I'm thinking of a mineral."
   c. "I'm thinking of a step that is important in processing ore."
4. Others in the group ask questions that can be answered with "yes" or "no," until they guess the word.
5. The leader (or someone else assigned) keeps track of the number of questions asked. If the word or term is not guessed with twenty questions or less, the leader tells the word to the group and goes to a new word.

TEACHER INFORMATION

Object of the Game:
To guess the word the leader is thinking of by asking yes/no questions, and to do it with as few questions as possible.

Prior Preparation:
1. Prepare a list of mining terms that is appropriate for the group involved. The glossary is an excellent source for the words. When playing the game, only the leader sees the list of words.

2. Consider the value of this game in developing classification skills. Work with students in categorizing things and ideas and in working from general to specific. The following sequence of yes/no questions in response to the clue, "I'm thinking of a word that starts with the letter D," for instance, begins with general questions which rapidly remove large numbers of possibilities. Progressively narrowing the categories in this way is a much more logical approach than to begin with questions such as, "Is it drill?" or "Is it derrick?" This training has the immediate benefit of greater skill with the game, and the long-range benefit of improved classification and questioning skills.

a. Is it a mineral? ..... No
b. Is it used in processing ore? ..... No
c. Is it used in removing ore from the mine? ..... Yes
d. Is it used to haul the ore? ..... No
e. Is it used to break up the ore? ..... Yes
f. Is it a machine? ..... No
g. Is it an explosive? ..... Yes
h. Is it dynamite? ..... Yes

MINING

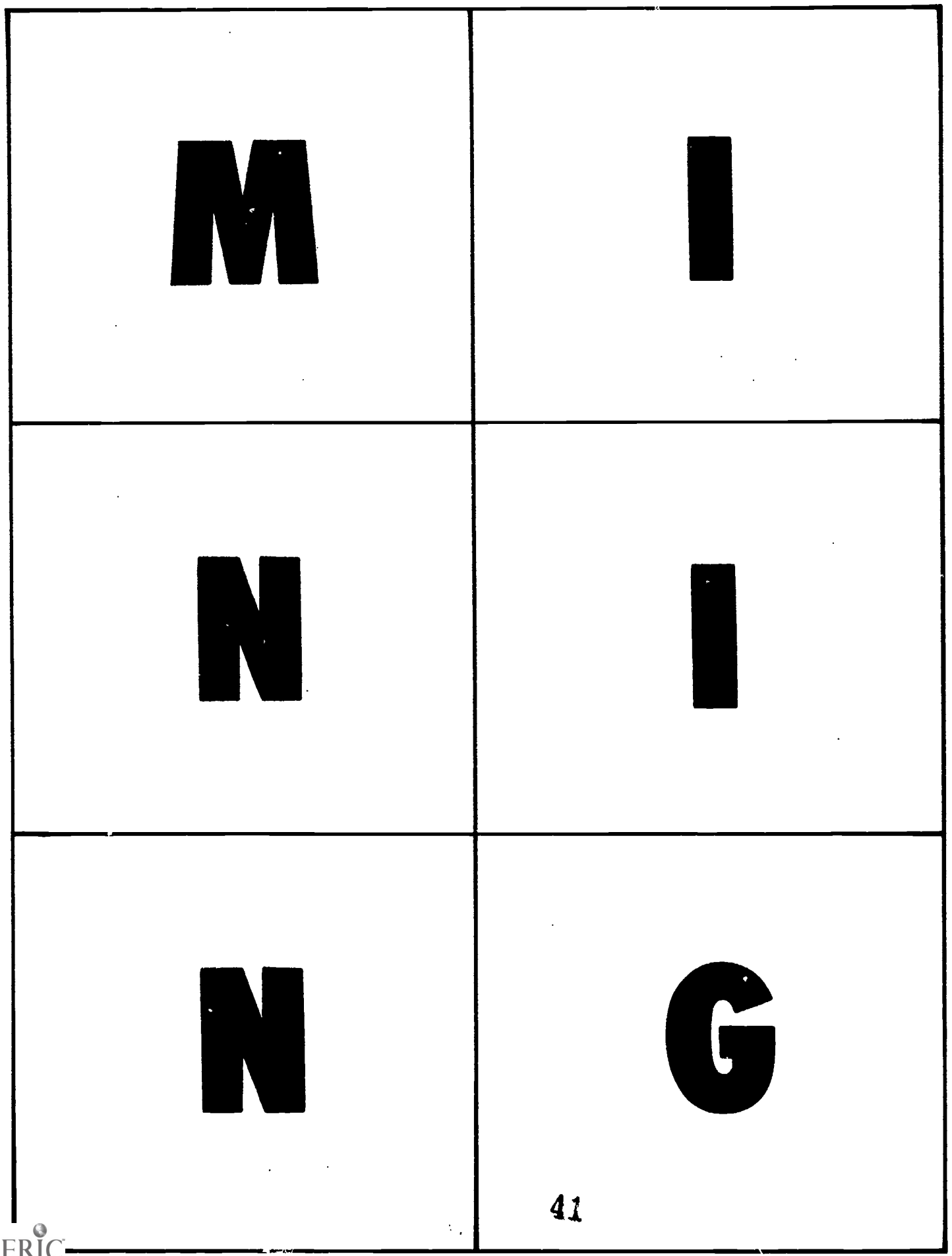
Materials Needed:
Word list Letter cards

Procedure:
1. Select a moderator.
2. Divide participants into two teams (or two individuals can play the game).
3. Determine which of the following skills the group will work on.
   a. Spell the word pronounced by the moderator.
   b. Give the definition of the word pronounced by the moderator.
   c. Give the word to match the definition stated by the moderator.
4. The moderator selects a word from the list and pronounces the word or gives the definition.
5. The first person responds according to the skill selected in step 3 above.
6. If the response is correct, the moderator gives the first team the letter "M."
7. The second team now has a turn. If the response in step 5 was incorrect, the second team gets the same word; if team one gave the correct response, the moderator selects a new word for team two.
8. The play continues in this manner until one team has won all the letters of the word "MINING."

TEACHER INFORMATION

Object of the Game:
To spell the word "MINING" by receiving the letters M-I-N-I-N-G one a time as a reward for demonstrating the target skill with mining terms.

Prior Preparation:
1. Prepare a list of mining terms appropriate for the group involved, including definitions. The glossary is an excellent source for the words.
2. Prepare two sets of six letter cards with M-I-N-I-N-G on them, one letter per card.


M I
N I
N G
41

MINING GLOSSARY GAME

Please see page 34

Materials Needed:
One standard die, or one number cube with the numbers 1-6 on the six faces
Mining Glossary Game Board
Game board markers
Set of question cards

Procedure:
1. Select a moderator.
2. The moderator shuffles the question cards and places them in a stack upside down.
3. The first player rolls the die.
4. The moderator takes the top question card and reads the question.
5. The first player answers the question.
6. If the answer is correct, the first player moves his/her marker the number of spaces indicated on the die tossed in step 2.
7. The second player rolls the die and gets the next question from the moderator.
8. The game continues in this manner until one player reaches or goes beyond "finish."

TEACHER INFORMATION

Object of the Game:
To progress around the game board, moving one's marker the number of spaces indicated on a tossed number cube or die if the player also responds correctly to a question asked by the moderator.

Prior Preparation:
Prepare a set of questions, appropriate for the participating group. Place each question on a separate card. Here are a few examples:

a. How does a pennyweight compare with a troy ounce? (1/20)

b. What is the name of a highly-porous, lightweight igneous rock? (pumice)

c. If you know someone with the blacklung disease, you know that person has spent a lot of time where? (in coal mines)

d. How deep would you dig to get soil from the A-horizon? (the A- horizon is topsoil)

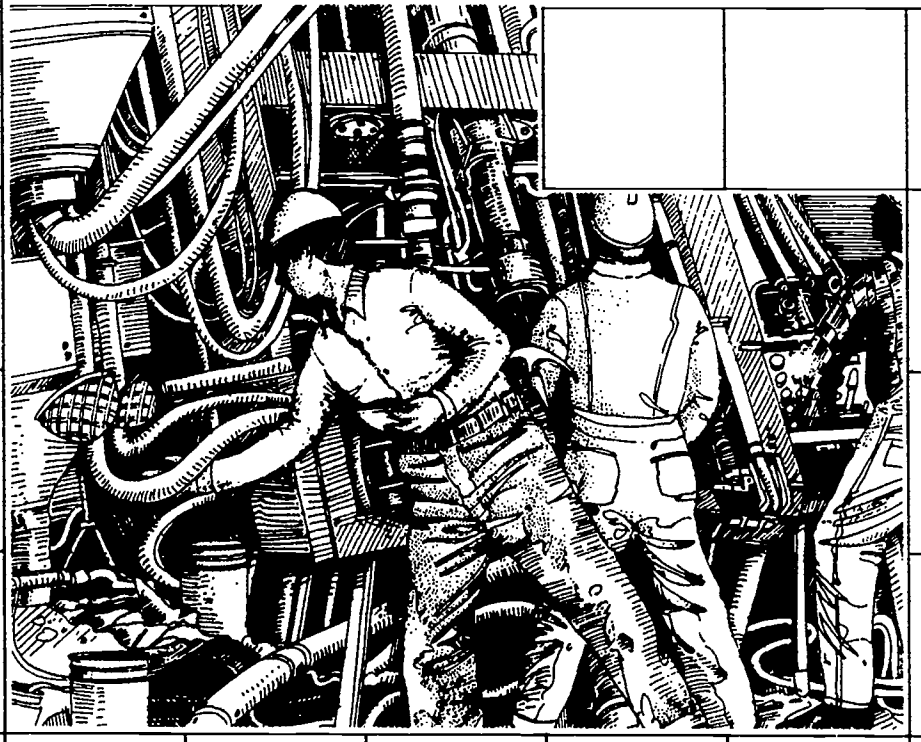
e. What happens if you strike flint sharply with a piece of steel? (you get a spark)

f. If you worked in a glory hole, would you need a flashlight at mid-day? (no, a glory hole is an open excavation)

START

GLOSSARY GAME BOARD

FINISH



WHAT AM I?

Materials Needed:
Clue cards

Procedure:
1. Select a moderator.
2. The moderator takes the top clue card and reads the first clue to the players.
3. If either of the players thinks he/she knows the word referred to, that person says the word.
4. If neither player gives the word, the moderator reads the second clue on the card. Again, players may say the word if they think they know.
5. If the word still has not been guessed, the moderator gives clue number three, which is the beginning letter of the word.
6. Scoring is as follows:
   a. The player giving the correct word first earns three points if he/she got the word with the first clue, two points if two clues were needed, and one point if three clues were needed.
   b. If a player guesses the wrong word, he/she may not try again until a new word is used, with a new set of clues.
7. If no player knows the correct word after three clues,the moderator tells the word to all players and selects the next clue card.
8. The game continues until a predetermined number of points are won by one player or until a predetermined number of clue cards have been used.

TEACHER INFORMATION

Object of the Game:
To earn points by guessing words from one, two, or three clues; the more clues needed, the fewer points earned.

Prior Preparation:
1. Select a set of words from the glossary, appropriate for the group involved.
2. Prepare clue cards, each with a set of three clues for one word. The third clue in each case is the first letter of the word. Here are a few examples.

a. What am I? (Geologist)
(1) I studied the history of the earth's crust.
(2) I have a college education.
(3) I begin with the letter G.

b. What am I? (Gun powder)
(1) I am a mixture of potassium nitrate, sulfur, and charcoal.
(2) I am an explosive.
(3) I begin with the letter G.

c. What am I? (Lead)
(1) I am the heaviest of the common metals.
(2) I am the softest of the common metals.
(3) I begin with the letter L.

d. What am I? (Iron)
(1) I am the cheapest of all metals.
(2) I am the most useful of all metals.
(3) I begin with the letter I.

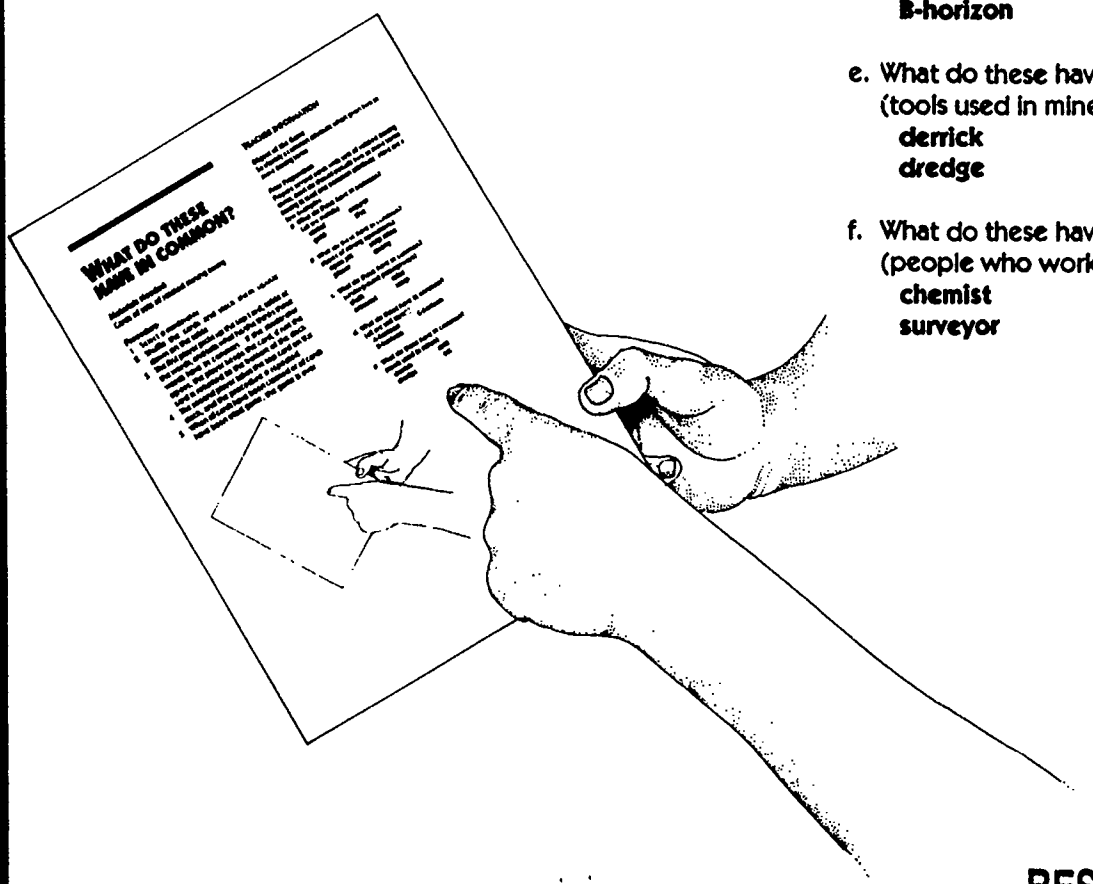
e. What am I? (Miner)
(1) I work in a mine.
(2) I am licensed for my work.
(3) I begin with the letter M.

f. What am I? (Mohs' scale)
(1) You use me to compare the hardness of minerals.
(2) I have values of 1 through 10.
(3) I begin with the letter M.

WHAT DO THESE HAVE IN COMMON?

Materials Needed:
Cards of sets of related mining terms

Procedure:
1. Select a moderator.
2. Shuffle the cards and stack them upside down on the table.
3. The first player picks up the top card, looks at the words, and tells what he/she thinks those words have in common. If the moderator agrees, the player keeps the card; if not the card is returned to the bottom of the deck.
4. The second player takes the top card on the stack, and the procedure is repeated.
5. When all cards have been claimed or all cards have been tried twice, the game is over.



TEACHER INFORMATION

Object of the Game:
To identify a common attribute when given two or more mining terms.

Prior Preparation:
Prepare several cards with sets of related mining terms, each set should include two or more terms having at least one common attribute. Here are a few examples.

a. What do these have in common?
(all are metals)
nickel **copper**
gold **zinc**

b. What do these have in common?
(types of mining operations)
open pit **strip mine**
placer **quarry**

c. What do these have in common?
(underground passageways)
shaft **raise**
crosscut **ramp**

d. What do these have in common?
(all are soil layers)
A-horizon **C-horizon**
B-horizon

e. What do these have in common?
(tools used in mines)
derrick **drill**
dredge **bit**

f. What do these have in common?
(people who work in mines)
chemist **geologist**
surveyor **inspector**

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ERIC

SYNONYMS OR ANTONYMS?

Materials Needed:
Cards of word pairs

Procedure:
1. Select a moderator.
2. Shuffle the cards and stack them upside down on the table.
3. The first player picks up the top card, looks at the words, and tells whether the two words on the card are synonyms or antonyms, and explains the reason for his/her choice. If the moderator agrees, the player keeps the card; if not the card is returned to the bottom of the deck. (It is possible that the same word pair could be either synonyms or antonyms, depending upon the reason given.)
4. The second player takes the top card on the stack, and the procedure is repeated.
5. When all cards have been claimed or all cards have been tried twice, the game is over.

TEACHER INFORMATION

Object of the Game:
To determine whether word pairs are synonyms or antonyms, and to be able to defend the decision.

Prior Preparation:
Prepare several cards, each with a pair of synonyms or a pair of antonyms. Here are a few examples.

a. Synonyms or antonyms and why? (antonyms--top and bottom layers of earth's crust)
A-horizon **C-horizon**

b. Synonyms or antonyms and why? (synonyms in that they both formed from magma; antonyms in that one was above the surface when it formed and the other under the surface)
extrusive rock **intrusive rock**

c. Synonyms or antonyms and why? (synonyms methods of separating minerals from other material)
leaching **washing**

d. Synonyms or antonyms and why? (antonyms--shaft is vertical, drift is horizontal; or synonyms because both are mine passages)
shaft **drift**

MINING CROSSWORD PUZZLES

Materials Needed:
Crossword puzzle
Pencil

Procedure:
1. Read the definitions of the words and write in the crossword puzzle the words you think fit those definitions. Be sure you notice whether the word goes across or if it goes down.
2. Use the glossary for help with definitions and spelling of words.

TEACHER INFORMATION

Object of the Game:
To complete the crossword puzzles accurately.

Prior Preparation:
No prior preparation is necessary if you plan to use the crossword puzzles provided. Otherwise, you can prepare a new crossword puzzle, or let students prepare new crossword puzzles, following the procedures described in the next activity. Students might enjoy making crossword puzzles for classmates to try.

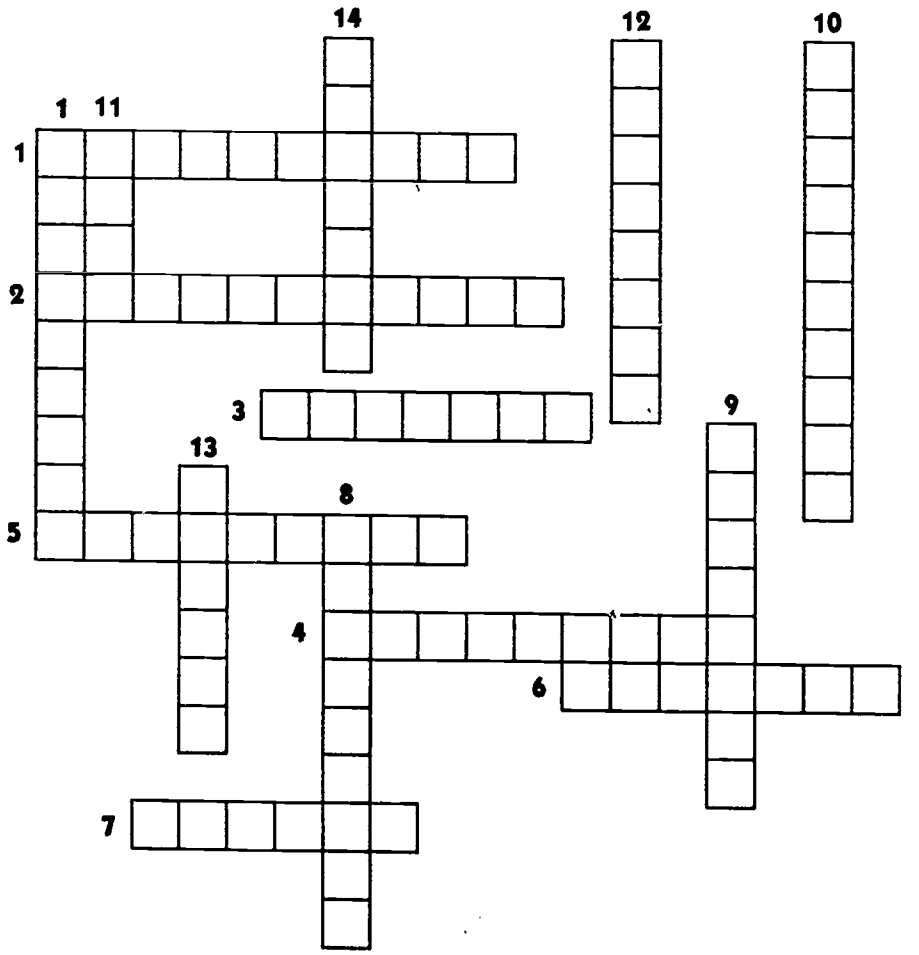
MINING CROSSWORD PUZZLE #1

DOWN

1. Rock formed from magma that solidified without reaching the earth's surface.
8. A substance which undergoes a rapid chemical change resulting in production of large volumes of gases and, if in a confined space, produces high pressures.
9. Stiffness or resistance to scratching, cutting, or bending.
10. A person engaged in exploring for valuable materials.
11. An opening or excavation in the earth for the purpose of extracting minerals.
12. Making holes for prospecting or mining purposes.
13. The science, technology, and business of mineral discovery, extraction, and marketing.
14. As a thing occurs in nature.

ACROSS

1. Undesirable elements or compounds in a material.
2. To restore to original condition, as in restoring the earth's surface after closing an open pit or other surface mining operation.
3. A regular polyhedral form, bounded by symmetrically-arranged plane surfaces.
4. Impurities which defile or make unclean, especially with reference to defiling natural resources.
5. Tools and machinery used in a mining operation or for other work.
6. An inorganic substance occurring in nature, with distinctive physical properties and definite chemical composition.
7. Any remains, impression, or trace of an animal or plant of past geologic ages.



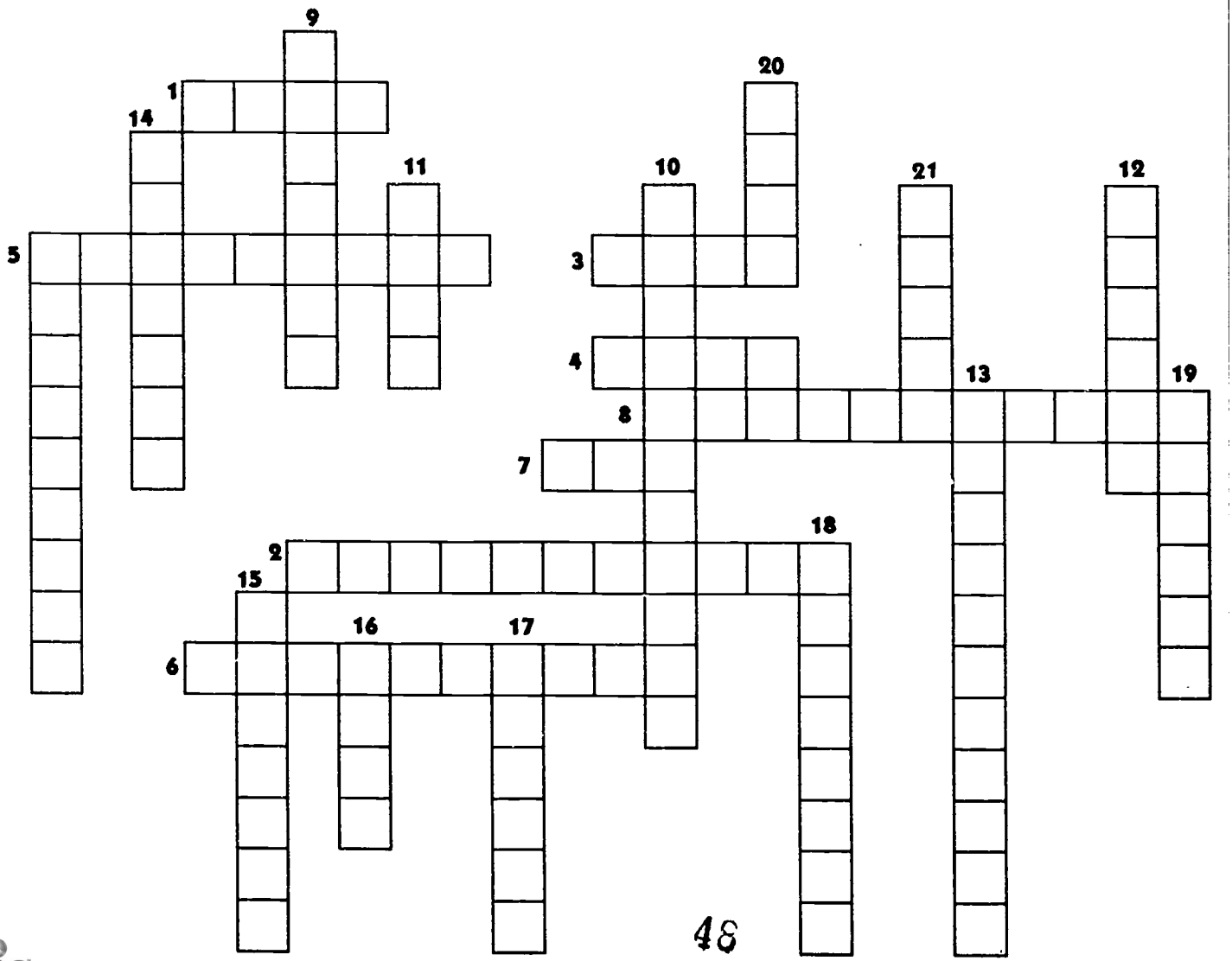
MINING CROSSWORD PUZZLE #2

ACROSS

1. Sample of rock obtained through the use of a hollow drilling bit.
2. The search for coal, mineral, or ore.
3. The heaviest and softest of the common metals.
4. An opening or excavation in the earth for the purpose of extracting minerals.
5. A rock bed or series of beds.
6. A person engaged in exploring for valuable materials.
7. A natural mass of minerals that can be mined at a profit.
8. Rock that has been altered by heat or intense pressure.

DOWN

5. Pyrite which can be used to strike sparks.
9. A regular polyhedral form, bounded by symmetrically-arranged plane surfaces.
10. Rock formed by the accumulation of sediment in water or from air.
11. A scale of hardness for the scratch test.
12. Any remains, impression, or trace of an animal or plant of past geologic ages.
13. To restore to original condition, as in restoring the earth's surface after closing an open pit or other surface mining operation.
14. A framework placed over a borehole to support drilling tools.
15. Course-grained igneous rock containing quartz, feldspar, and mica or other colored minerals.
16. Thin band of soft, inferior coal.
17. Common element, reddish in color and one of the best conductors of electricity.
18. A chemical element that lacks most of metallic properties and is able to form chemical compounds with hydrogen.
19. An underground chamber.
20. A substance typically soluble in water, sour or biting to the taste and turns litmus paper red.
21. A stick tied to the end of a rope which is used to lower men into a mine.



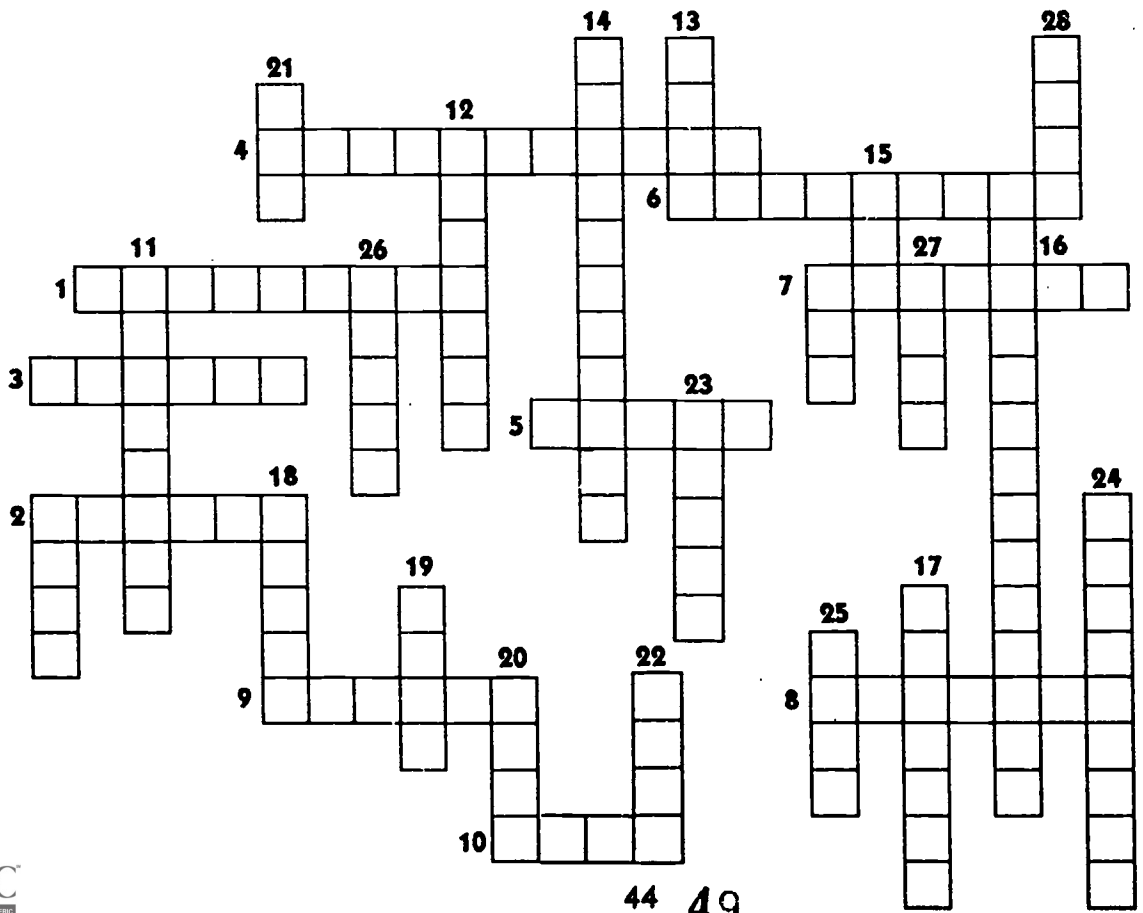
MINING CROSSWORD PUZZLE #3

ACROSS

1. Rock formed from magma that solidified without reaching the earth's surface.
2. A material containing potassium.
3. The science, technology, and business of mineral discovery, extraction, and marketing.
4. Rock formed by the accumulation of sediment in water or from air.
5. A vertical passage used for finding or mining ore.
6. A substance which undergoes a rapid chemical change resulting in production of large volumes of gases and, if in a confined space, produces high pressures.
7. The science that deals with the history of the earth recorded in the rocks.
8. To obtain ore left standing during previous operations.
9. A horizonal underground passage that opens to the surface at both ends.
10. Any gas occurring in mines, especially coal mines.

DOWN

2. A heavy pointed iron or steel hand tool.
7. A precious or semiprecious stone cut and polished as an ornament.
11. A chemical element that does not have most typical metallic properties.
12. An inorganic substance occurring in nature, with distinctive physical properties and definite chemical composition.
13. Sample of rock obtained through the use of a hollow drilling bit.
14. Rock that has been altered by heat or intense pressure.
15. A natural mass of minerals that can be mined at a profit.
16. The process or product of concentration.
17. A general term to refer to all types of machines used in mines.
18. A lifting apparatus such as an elevator.
19. Fine grains or particles of rock, smaller than pebbles.
20. Metallic element. Heaviest and softest of the common metals.
21. The solid residue left when combustible material is burned.
22. Machine used to move liquid or gas, usually within a pipeline.
23. A fracture in the earth's crust.
24. An instrument for measuring the specific gravitiy of liquids.
25. Without moisture, dry.
26. A bar of metal.
27. A gemstone which often displays an iridenscent play of colors.
28. A block of fine abrasive used for grinding or sharpening.



MAKE YOUR OWN CROSSWORD PUZZLES

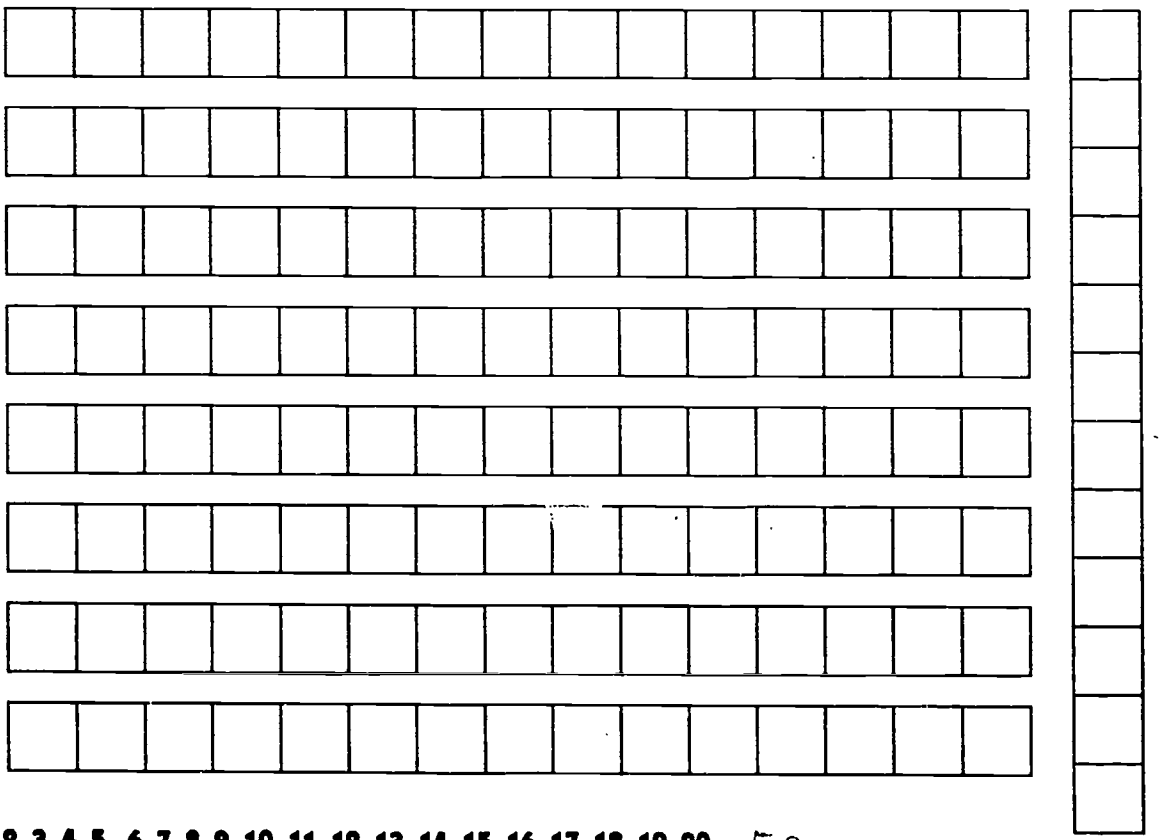
Materials Needed:
Crossword Puzzle Strips (3 copies)
List of words
Scissors
Pencil

Procedure:
1. Prepare a list of words and definitions for use in the crossword puzzle.
2. On one copy of the "Crossword Puzzle Strips," write each word twice--once vertically and once horizontally.
3. Cut out the vertical and horizontal strips for each word you want to consider for the puzzle. You will need a few extra blank strips.
4. Place the word strips on a blank piece of paper arranging and rearranging until you find your preferred pattern.
   a. Some vertical words should overlap some horizontal words where they have the same letters.
   b. It isn't necessary that you use all of the words you selected.
   c. Use only one form of any given word--either the horizontal form or the vertical form, but not both.
5. Using another set of crossword strips,
   a. Mark out all spaces that are unused on the new pattern.
   b. Write numbers in the spaces occupied by the first letters of words, both vertically and horizontally.
6. Make a list of definitions for the words you actually used in your puzzle. Divide this list of definitions into two sets--across and down.
7. Your new crossword puzzle should now be ready to use. Make copies of it and save the original for making more copies later.

TEACHER INFORMATION

Object of the Game:
To make crossword puzzles accurately.

Prior Preparation:
No prior preparation is necessary unless students need help in preparing a list of words and definitions. Words can be obtained from the glossary.



1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

50

MINERAL PASSWORD

Materials Needed:
List of words

Procedure:
1. Divide the class into two teams. Give the teams names; we'll say Team A & Team B.
2. Arrange the teams into separate groups, such as semi-circles.
3. Select a clue-giver for each team, or have the teams select their own.
4. Show the clue-givers of both teams the same word.
5. Determine who will start the game by drawing straws, rolling dice, guessing a number, or some other method. We'll say Team A starts the game.
6. The clue-giver of Team A gives a one-word clue to his/her team. Team B must also hear the clue. If someone on Team A cares to guess the word, they do so. (If correct, another word is selected and shown to both clue-givers.) If incorrect, the turn goes to Team B.
7. The clue-giver of Team B gives a one-word clue to his/her team and the same procedure is followed.
8. The two teams take turns giving one-word clues until someone guesses the word.
9. Each new word begins with the team that did not win the game for the previous word.

TEACHER INFORMATION

Object of the Game:
To guess words from clues given by a team member, similar to the TV game "Password."

Prior Preparation:
1. Prepare a list of mineral names or use the ones here:

GOLD	ALUMINUM	BASALT
BIT	SILVER	COAL
COMPOUND	CONCENTRATE	CORE
CRYSTAL	DRILL	DYNAMITE
EXPLORE	EXPLOSIVE	EXTRUSIVE
FORMATION	FOSSIL	GEOLOGIST
MOHS SCALE	INGOT	LEAD
MINE	ORE	PROSPECTER

2. Prepare students by practicing the spelling and meaning of each word in the list.

MINING LINGO

Materials Needed:
List of words
Definition cards
Lingo cards
Markers (M & M's or other small candies work great!)

Procedure:
1. Assign one person to be the moderator.
2. Each person receives a Lingo card and several markers.
3. Display the list of mining terms on transparency, chart, or chalkboard.
4. Each player selects 24 of the terms and writes them in separate spaces on his/her Lingo card, leaving the center space open as a "free" space.
5. The moderator shuffles the deck of definition cards, places them upside down in a stack, then takes the top card and reads the definition.
6. Each player who recognizes the definition as matching one of the words on his/her Lingo card places a marker on that space.
7. The moderator reads the definition from the next card in the stack, and the process continues until one of the players hollers "Lingo."
8. The player claiming "Lingo" must now tell the group which words are marked in line (down, across, or diagonally) on his/her card, stating the definition of each.
9. If the words claimed by the player had all been used by the moderator, and if the definitions are all given correctly (not word-for-word, but must be accurate), the player wins that round and a new round begins by shuffling the definition cards again. If there are errors in words claimed or in definitions given, the game continues as though "Lingo" had not been claimed.

TEACHER INFORMATION

Object of the Game:
Place markers on a Lingo card (like Bingo) as player recognizes definitions of mining terms.

Prior Preparation:
1. Prepare Lingo grid cards (sample on the next page).
2. Prepare a list of mining terms (about 30) appropriate for the group using the game, and a separate definition card for each term on the list. Here are some examples:

List of terms

ABRADE	ALCHEMY
ALLOY	BEAM
BRONZE	CAVERN
COKE	COPPER
CRUST	EXCAVATING
FLINT	FOSSIL
GONDOLA	GUY
HARDHAT	IMPERMEABLE
INGOT	LEACH
LENS	METHANE
MAGMA	OVERBURDEN
PUMP	QUARRY
QUICKSILVER	RECLAIM
SCREE	SKIP
STRIKE	STRIP MINE

DEFINITIONS

ABRADE: To rub or wear off through friction.

ALCHEMY: Chemistry of the Middle Ages based on the search of changing ordinary metals to gold.

ALLOY: A mixture of metals

BEAM: A bar or girder used to support a section of roof in a mine.

BRONZE: Alloy composed mainly of copper and tin.

CAVERN: An underground chamber.

COKE: Bituminous coal from which the volatile constituents have been driven off by heat without flame.

COPPER: A common metal which is reddish in color and one of the best conductors of electricity.

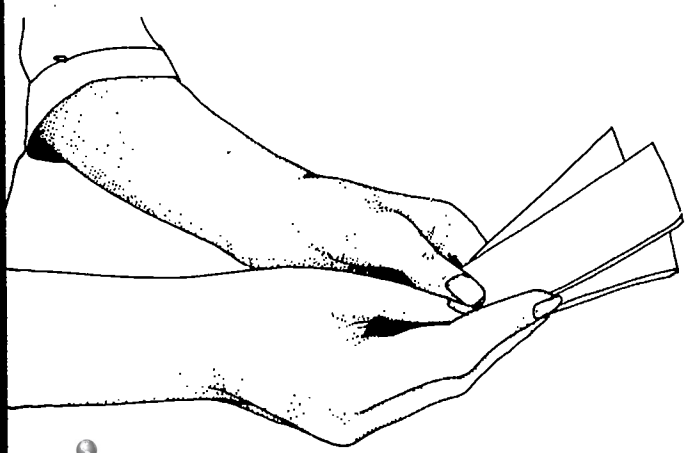
CRUST: The outer layer of the earth.

EXCAVATING: The process of digging, blasting or breaking materials in the earth and then removing them.

FLINT: A very hard quartz which will spark when struck against steel.

FOSSIL: Any remains, impressions, or trace of prehistoric plants or animals.

GONDOLA: Flat bottomed railroad car with no top that is used to haul steel, rock or heavy bulk items.



GUY: A rope or cable that is attached to the ground and which supports a tower or tall structure.

HARDHAT: Term used for a safety helmet.

IMPERMEABLE: Having a texture which does not permit water to move through it under ordinary pressures.

INGOT: Bar of metal.

LEACH: To dissolve metals or minerals by use of chemicals, acids or water.

LENS: A body of ore or rock which is thicker in the middle than at the edges.

MAGMA: Molten material within the earth.

METHANE: The most common gas found in coal mines.

OVERBURDEN: The soil or rock that covers a mineral deposit.

PUMP: A machine which moves liquid or gas, usually within a pipeline.

QUARRY: An open mine, usually engaged in cutting building stone, slate, marble or limestone.

QUICKSILVER: A common name for mercury.

RECLAIM: To restore to original or near-original condition.

SCREE: Long trails of loose rock that slope beneath steep mountain sides.

SKIP: A high speed elevator that carries ore to the surface.

STRIKE: To discover a vein of ore.

STRIP MINE: An opencut mine in which materials are removed by surface methods.

LINGO

		FREE SPACE		

LINGO

		FREE SPACE		

LINGO

		FREE SPACE		

LINGO

		FREE SPACE		

MINING CONCENTRATION

Materials Needed:
Set of word cards
Set of definition cards

Procedure:
1. Place the word cards and the definition cards upside down on a table, and spread out so that no card is on top of another card.
2. The first player turns over one card of each of the two colors. If he/she has a word and its matching definition, the player keeps the cards. Otherwise the two cards are turned face down again in the same position on the table.
3. The second player turns over one card of each color, and this procedure continues until all cards have been claimed.
4. The player with the most cards wins the game.

TEACHER INFORMATION

Object of the Game:
Match words and definitions from separate sets of cards placed upside down on table, in standard procedure for the game of Concentration .

Prior Preparation:
1. Prepare a list of mining terms appropriate for use with the participating group (about 12-20).
2. Write each of these terms on a separate card.
3. Write the definition (as short and simple as possible) for those terms on a separate set of cards of a different color.

Sample set of terms

BAUXITE
CHUTE
GEM
INGOT

DEFINITIONS

BAUXITE: A rock composed of aluminum hydroxides. The principal ore of aluminum.

CHUTE: An inclined channel underground, or trough above ground, through which ore falls from a higher level to a lower level.

GEM: Any precious or semiprecious stone.

INGOT: A mass of cast metal as it comes from the mold, such as a bar of gold or silver.

MINING TIC-TAC-TOE

Materials Needed:
Game board
Game board markers
Sets of terms and definitions for each of several categories

Procedure:
1. Select a moderator.
2. The moderator shuffles the question cards for each category and places them in separate stacks upside down.
3. The first player chooses a category.
4. The moderator takes the top question card for that category and reads the term.
5. The first player defines the term (not word-for-word, but must be accurate).
6. If the definition is correct, the first player places one marker on the game board. If the definition is not correct, the turn goes to the next player.
7. The second player selects a category and is given a term to define. If correct, he/she places a marker on the game board.
8. The game continues in this manner until one player gets three markers in a row, winning the game.
9. Each time a card is used it is returned to the bottom of the stack from which it came.

TEACHER INFORMATION

Object of the Game:
To place three markers in a row, as in the regular Tic-Tac-Toe game.

Prior Preparation:
1. Prepare Tic-Tac-Toe game boards.
2. Prepare a set of terms and definitions in each of several categories, all having to do with mining. Place each term/definition on a separate card. Use a different color of card for each category. Here are a few examples:

Passages in a Mine

ADIT: A nearly horizontal passage from the earth's surface into a mine.

CHUTE: An inclined channel underground, or through above ground, through which ore falls from a higher level to a lower level.

CROSSCUT: An underground passageway running at right angles to the main entry to connect it with a parallel entry or with an air course. Sometimes across a vein to test the width of the vein. In general, any drift driven across between two main openings for a mining purpose.

DRIFT: A horizontal underground passage that follows a vein of ore, as opposed to a crosscut, which crosses the vein.

RAISE: A passage driven upward from a lower level toward an upper level in an underground mine.

RAMP: An inclined underground opening that connects levels or production areas.

SLOPE: (1) An inclined passage within a mine. (2) The inclination of a mine roadway or coal seam.

WINZE: A passage driven downward from one level to another in an underground mine. In construction it differs from a raise only in that the winze is excavated downward and the raise is excavated upward. When completed, it is called a winze if one is at the upper level looking down and a raise if one is on the lower level looking up.

Mining Careers

AERIAL MAPPING: The taking of continuous vertical photographs from an airplane for geophysical and other purposes.

CHEMIST: A person skilled in making chemical examinations or investigations.

GEOLOGIST: One who studies the structure and history of the earth's crust.

LABORER: (1) A man hired by the contract miner to assist him. (2) A person working for day wages in or about a mine.

METALLURGICAL ENGINEER: One who applies engineering principles to the science and technology of metallurgy.

METALLURGIST: One who is skilled in, or practices, metallurgy.

MINE INSPECTOR: One who checks mines to determine the safety condition of working areas, equipment, ventilation, and electricity, and also to detect fire and dust hazards.

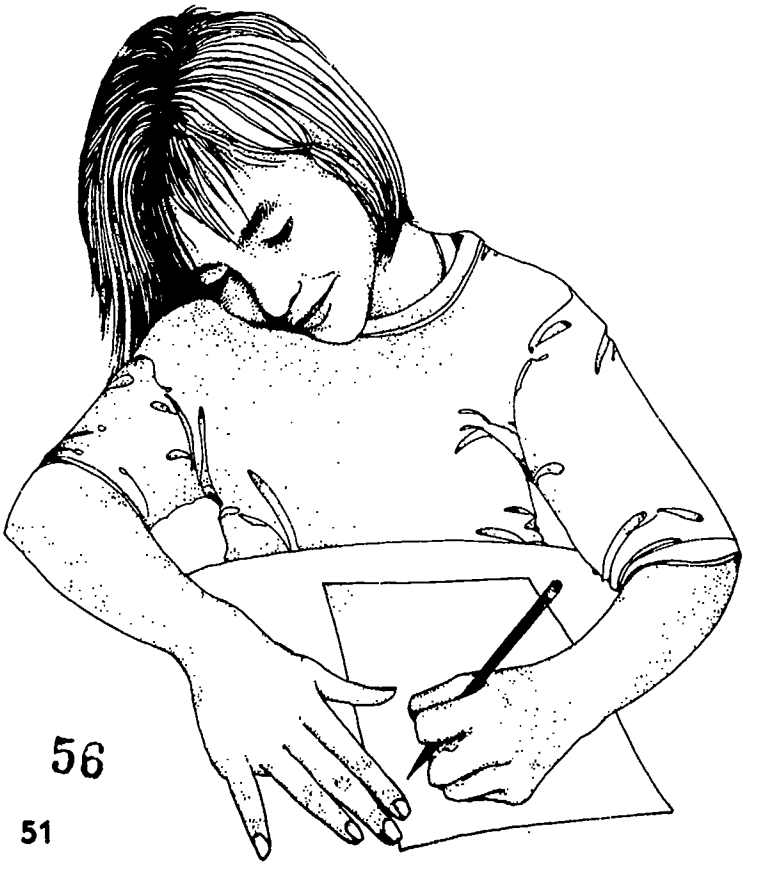
MINER: (1) Any worker in a mine. (2) Technically, only those who have served an apprenticeship as helpers and those who are licensed by the state as miners.

MINING ENGINEER: Usually a trained specialist in one or more of the branches of mining work, i.e., prospecting, surveying, sampling and valuation, technical underground management, milling, assaying, ventilation control, geological examination, and administration.

PHYSICIST: One who is a specialist in physics or well-versed in the natural sciences.

PROSPECTOR: A person engaged in exploring for, or in testing supposed discoveries of, valuable minerals.

SURVEYOR: One who surveys land.



ALUMINUM: A light, silvery-white metal with high electrical conductivity and good resistance to corrosion. Obtained from bauxite.

ASPHALT: A bitumen of variable hardness and comparatively nonvolatile.

BAUXITE: A rock composed of aluminum hydroxides. The principal ore of aluminum.

BITUMINOUS COAL: A high-quality coal, dark brown to black in color.

BROWN COAL: A low-quality coal, brown to brownish-black in color. Commonly contains structures of the wood from which it was formed. It is high in moisture and low in heat value. It is intermediate between peat and bituminous coal.

COAL: A black, or brownish-black, solid, combustible, carbonaceous rock, formed by partial to complete decomposition of vegetation without free access of air and under proper conditions of moisture, pressure, and temperature.

COBALT: A tough, lustrous, metal. Magnetic and nickel-white or silvery- gray in color. Similar to iron but harder.

COKE: Bituminous coal from which the volatile constituents have been driven off by heat without flame.

COPPER: A common element, reddish in color and one of the best conductors of electricity and heat.

FELDSPAR: One of a group of rock-forming minerals. Mohs' hardness , 6; specific gravity 2.5 to 3. Important in glass and ceramic industries.

GEM: Any precious or semiprecious stone.

GOLD: A yellow metallic element. The most precious metal used as a common commercial medium of exchange.

GRANITE: A course-grained igneous rock containing quartz, feldspar, and mica or other colored minerals.

IRON: The cheapest, most abundant, most useful, and most important of all metals.

LEAD: A metallic element. The heaviest and softest of the common metals.

MAGNETITE: An igneous rock consisting essentially of magnetic iron ore.

MANGANESE: A hard, brittle metallic element, grayish-white tinged with red; rusts like iron; not magnetic.

MICA: Any of a group of mineral silicates crystallizing in forms that readily separate into very thin leaves. Some forms are transparent and are popularly called isinglass.

NICKEL: A hard, malleable, silvery-white metallic element, resistant to corrosion, able to take a high polish, and attracted by magnets. A fairly good conductor of heat and electricity.

OBSIDIAN: Volcanic glass. Usually black, but known also to be red, green, and brown.

PETROLEUM: Material occurring naturally in the earth, composed predominantly of hydrocarbons. Such material may be in gaseous, liquid, or solid state, depending on the nature of the compounds and the conditions of temperature and pressure.

POTASH: Originally referred to potassium carbonate recovered from wood ashes, but often used now in reference to any material containing the element potassium.

URANIUM: A radioactive, silvery-white metallic element.

ZINC: A lustrous, bluish-white metallic element. Brittle at ordinary temperatures; malleable at temperatures 100 to 150 degrees Celsius. Used in many alloys, including brass, bronze, nickel-silver, bearing metal, and soft solder.

ALLUVIAL MINING: The exploitation of alluvial deposits by dredging, hydraulicking, or drift mining.

BLASTING: The operation of breaking coal, ore, or rock by boring a hole in it, inserting an explosive charge, and firing it.

CONCENTRATING: Separating the waste materials from the minerals.

CONTOUR MINING: Strip mining around hills or mountains.

CORE DRILLING: The process of obtaining rock samples by using a hollow drilling bit.

CRUSHING: The process of pulverizing ore by stamps, crushers, or rollers.

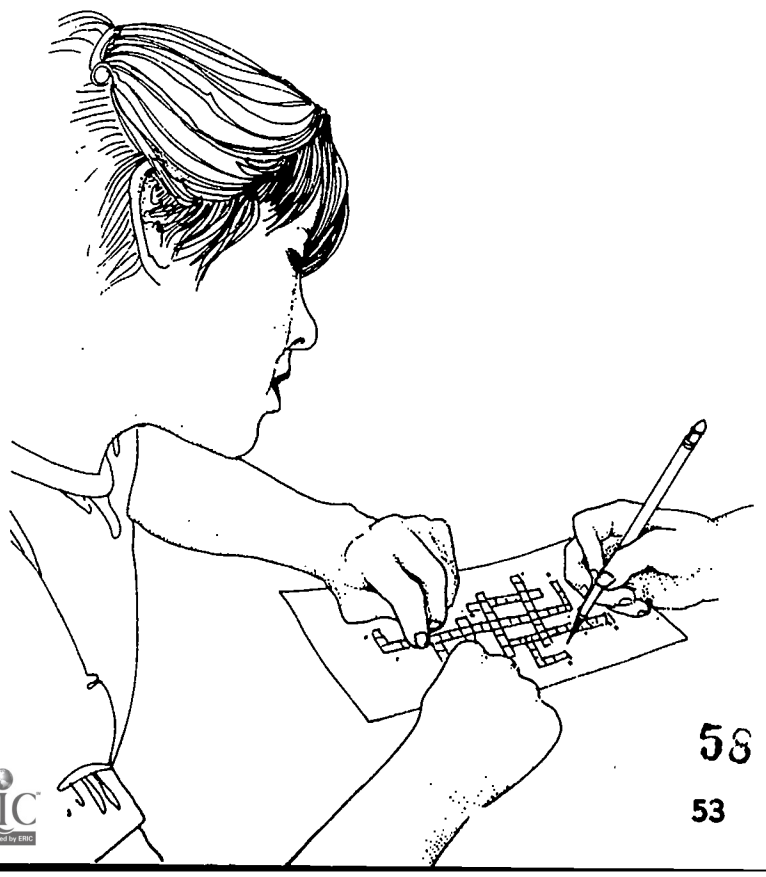
DIFFERENTIAL FLOTATION: Separating a complex ore into two or more valuable minerals and gangue by flotation. Also called selective flotation.

DREDGING: (1) The act of using a dredge. (2) The material brought up by a dredge.

DRILLING: (1) The process of making a circular hole with a drill. (2) Making holes for prospecting or mining purposes.

DRIVE: To excavate horizontally or at an inclination, as in a drift or adit.

EXCAVATION: Digging and removing soil; blasting, breaking, and loading of coal, ore, or rock in mines.



EXPLORATION: The search for coal, mineral, or ore, as by geological surveys, prospecting, or use of tunnels, drifts or boreholes.

FLOTATION: Separating ore from waste materials by floating away the materials of lower specific gravity, while the heavier materials sink.

FRASCH PROCESS: A process used in mining sulfur in which superheated water is forced into the sulfur deposit for the purpose of melting the sulfur. The melted sulfur is then pumped to the surface.

GRINDING: Reducing material into fine particles by friction.

LEACHING: The action of percolating liquid in order to remove the soluble parts.

LONGWALL MINING: Removing all coal or ore from horizontal seams. Supports of stone and timber are built instead of leaving pillars of coal or other natural material.

MILLING: (1) The grinding or crushing of ore. (2) Removing valueless or harmful constituents from ore and preparing it for market.

OPEN-PIT MINING: Extracting minerals that lie near the surface.

PANNING: Washing earth or crushed rock in a pan, agitating with water, to obtain the particles of greatest specific gravity. Mainly practiced for gold, but also for diamonds and other precious gems.

RECLAIM: To obtain ore left standing during previous operations.

RESTORATION: To restore to original condition, as in restoring the earth's surface after closing an open pit or other surface mining operation.

ROOM-AND-PILLAR MINING: A method of mining coal or ore in which the roof is supported by pillars left at regular intervals.

SCREENING: The separation of solid materials of different sizes, by causing larger components to remain on top of a perforated surface, while smaller components drop through to a lower level, possibly onto another perforated surface for finer screening.

STRIP MINING: The mining of coal by surface mining methods, as distinguished from the mining of metal ores by surface methods, which is commonly called open-pit mining.

STRIPPING: The process of removing the overburden from a mineral deposit or quarry.

SURVEYING: Determining the area of any portion of the earth's surface by taking linear and angular measurements and by applying the principles of geometry and trigonometry.

MINING WORD SEARCH 1

In addition to having students do the "Word Search" activities, consider having them prepare new "Word Search" activities for classmates to do. Learning gains will be even greater in creating the activity than in doing it as a game.

S W T A O P L Q I D Z Y E T H V D S A
X V N A A T T H J Z Q P N H W S A I S
C T L O L R M E T A L L I C O M I S T
A Y M O P U J E I P M N H I W I B L E
D C A E L E M E N T T R C I T N O T M
S Y P O A Y B I G B M T A R E E A L K
D L O G W Q R N N U L A M T V R X A L
B N L R F M E G J U W S G Z E A K V C
M Y L T W S C O H B M R H M A L O Z T
R F U N B T L T H O M G O P U E Y B N
U H T U S O A K V F E L D S P A R T K
T U I I H B M O P T G U R L X V E A T
W N O G A I A N T N E D I J K T R S A
Q H N O F A T N O G E O L O G I S T E
W S C V T B I C M A E J L U H G F A M
F C Y H N W O K U I O D Z S A P L M A
J M L A O H N W O L H D C B N W I O P

ALUMINUM
ELEMENT
GOLD
MACHINE
POLLUTION
CONGLOMERATE
FELDSPAR
HOIST
METALLIC
RECLAMATION
DRILL
GEOLOGIST
INGOT
MINERAL
SHAFT

MINING WORD SEARCH 2

B A M I N I N G A I D K J L W T
P O U K G N R S F A O U Y M H I
C H E M I S T D I A S H S S X N
L M I O B T W E C U J I U O L K
P E F M A R K E T C S M B I E W
E K N A L U L B R Y E O S M N S
T U N O P M W D L A T S Y R C V
R U J H G E A O R T O J N B R T
O L M N T N R I A F I H B P M N
L V B Y I T L O A V T X L R O W
E C S A C J U I L N T D E O Q U
U U G E O L O G Y A W E V S Y T
M O L M D T Y R L M N O P P E A
B E X P L O S I V E T R H E L O
Z S M E L T I N G Q U O T C K Y
V U O L B F K D G A O U J T M N
I M P U R I T I E S A E D O N H
V U Q R E U L N G I U F O R W V
A E V T Y M O G M B S T I H B W

CHEMIST
CRYSTAL
ELECTROLYSIS
EXPLOSIVE
FOSSIL
GEOLOGY
GRINDING
IMPURITIES
INSTRUMENT
MARKET
MINING
PETROLEUM
PROSPECTOR
SMELTING

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MINING WORD SEARCH 3

A N O K L M T I Z C T G H F U Y
N O G R T B A L N Y U Q P I Z A
S I R B R A F B L D M C T L A S
N T A X A K M U H V U S A T O N
F A N L N W R S O U T S Y E K L
O C I N S E A L Q U O P T R W Z
N I T C P T I U T M N B W R C V
B F E K O B S I D I A N Y R Y L
Q I N P R P U T O N O R S T Y N
A D T N T O P R A E S T I C R N
W I Q U I N N E E P N O D I E K
P L U Q W R T A R B C X A V S E
A O V T H I J L M N K Y E T T M
W S A O M N R C I T B Q L T O M
E X H A U S T T I L A T B F R L
R E N O R A L T O A H I S T A W
C Y O M E T A L L U R G I S T P
D R O H N O M I N O G H T Y I B
D E R L O U G H T Y V O G E O L
Q U E R T A T I O N A R Y M N E

COPPER
FILTER
LEAD
OBSIDIAN
SALT
DYNAMITE
GRANITE
METALLURGIST
POTASH
SOLIDIFICATION
EXHAUST
INDUSTRY
MINE
RESTORATION
TRANSPORT

DEFINITION GRID

Materials Needed:
Word cards
List of words and definitions
Game board
Marker for each player

Procedure:

1. Place the word cards upside down on the table.
2. Assign a moderator.
3. Determine the order of play.
4. The first person draws the top card off the stack, reads the word aloud, and defines the word.
5. The moderator judges the definition correct or incorrect, using the list of words and definitions. Definitions do not need to be word for word, but only to have the right meaning. The moderator is the judge.
6. If the definition is correct, the player moves his/her marker one position on the game board for each u, d, r, or l in the word. Move up one for each u, down for each d, right for each r, and left for each l. The number landed on is added to the player's previous score.

   Note: If you need to move down and you are already on the bottom row of numbers, pretend the game board is like a cylinder and can be rolled up with the top off the game board touching the bottom. Thus, your marker goes to the top square of the same column. Use the same procedure for moving right or left.

7. If the definition is incorrect, the moderator defines the word for the group, returns the card to the bottom of the stack, and the next player takes a turn by selecting the top card.
8. The first person to reach a score of 21 wins the game. A score that goes past 21 still wins the game.

Variation: When one person cannot define a word, or defines it incorrectly, the next player has the option of either using that word or taking a new word off the top of the stack.

TEACHER INFORMATION

Object of the Game:
To acquire points by defining words related to mining.

Prior Preparation:

1. Prepare a set of word cards, each having one word (or term) on one side and the other side blank. Use any words from the glossary that are appropriate for the group involved and which contain one or more of the letters u, d, r or l.
2. Prepare a list of all words used on the cards, complete with definitions.
3. Prepare a game board. Make adjustments as desired or needed. Here is an example:

1	2	3	4	5
2	3	4	5	1
3	4	5	1	2
4	5	1	2	3
5	1	2	3	4

AUTO RACING

Materials Needed:
Word cards
List of words and definitions
Game board
Car (marker) for each player

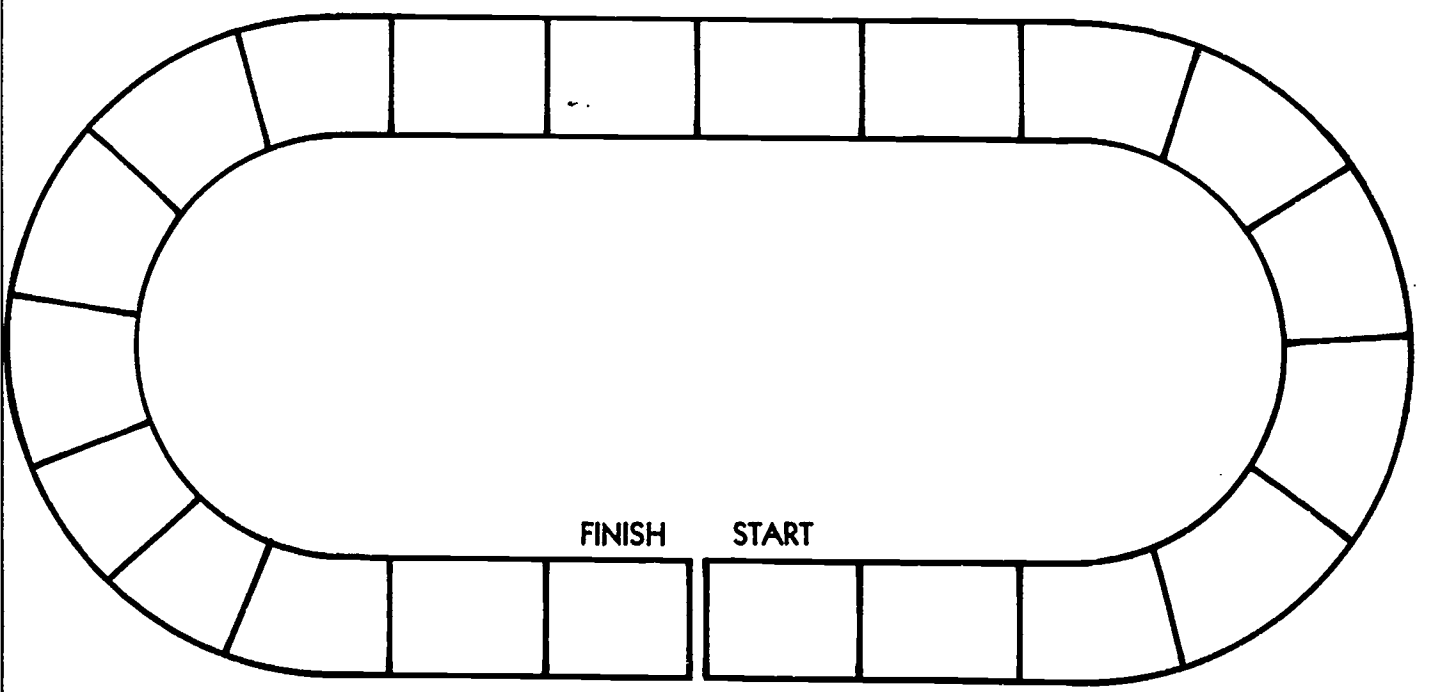
Procedure:
1. Place the word cards upside down on the table.
2. Assign a moderator.
3. Determine the order of play.
4. The first person draws the top card off the stack, reads the word aloud, and defines the word.
5. The moderator judges the definition correct or incorrect, using the list of words and definitions. Definitions do not need to be word for word, but only to have the right meaning. The moderator is the judge.
6. If the definition is correct, the player moves his/her car one position on the game board.
7. If the definition is incorrect, the moderator defines the word for the group, returns the card to the bottom of the stack, and the next player takes a turn by selecting the top card.
8. The first person to the finish line wins the game.

TEACHER INFORMATION

Object of the Game:
To complete the trip around the race track by defining mining terms correctly.

Prior Preparation:
1. Prepare a set of word cards, each having one word (or term) on one side and the other side blank. Use any words from the glossary that are appropriate for the group involved.
2. Prepare a list of all words used on the cards, complete with definitions.
3. Prepare a game board. Here is an example:

VARIATION:
When one person cannot define a word, or defines it incorrectly, give the next player the option to either use that word or take a new word from the top of the stack.



DEFINITION MATCH'N

Materials Needed:
List of terms and definitions.
Set of cards, each with a mining term on one side and blank on the other.
Set of cards, each with a definition on one side and blank on the other.

Procedure:
1. Assign a moderator.
2. Determine the order of play.
3. The moderator puts both sets of cards together and shuffles them as one set, then deals six cards to each player. The remaining cards are placed upside down in the middle of the table.
4. Players check their cards to see if they think they have any matching pairs. If so, they put them in pairs and discard them (set them aside).
5. The first person draws a card from the stack. If the card drawn (term or definition) matches with a card in his/her hand, the player discards the pair. If not, he/she lays this card or another card down in front of him/her, face up.
6. The next player tries to match with any cards that are face up in front of other players. If he/she can match a card in hand with any card that is face up on the table, the player does so and discards the pair. Then the player may still draw from the stack and if the new card matches with one in his/her hand or in front of any player, he/she discards and draws again until he/she no longer gets a matching pair.
7. If the word given was incorrect, that player does not get a second chance at that particular definition. The other player may wait until the definition is finished, then state the word or give a best guess. If correct, the puck moves one position toward the opponent's net.

TEACHER INFORMATION

Object of the Game:
To match mining terms with definitions and be the first to run out of cards.

Prior Preparation:
1. Select a set of terms from the glossary, appropriate for the group involved. There should be at least 8 or 10 times as many words as players.
2. Make a list of selected terms, complete with definitions.
3. Write each term on one card and each definition on a separate card. One side of each card should be blank.

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DEFINITION HOCKEY

Materials Needed:
List of words, large enough that all participants can see it well
List of words and definitions
Game board
Hockey puck (a paper disk will do, perhaps a punch-out from a paper punch)

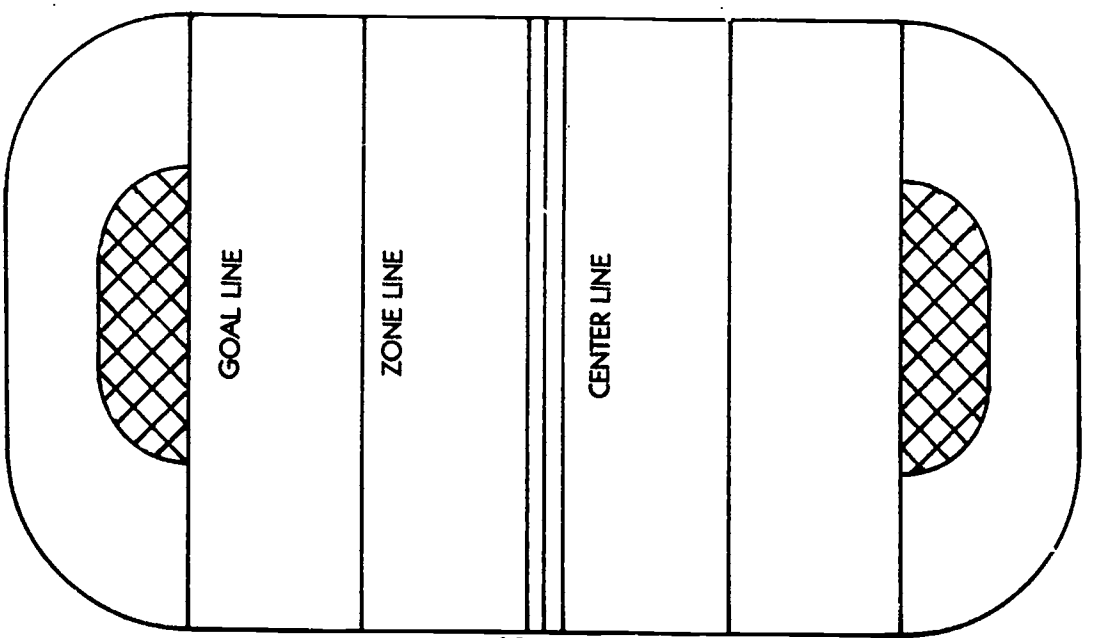
Procedure:
1. Display the list of words where all can see.
2. Assign a moderator.
3. Place the hockey puck on the center line.
4. The moderator reads aloud one of the definitions from the list of words and definitions.
5. Both players listen carefully to the definition, and as soon as a player thinks he/she recognizes the definition, he/she says the word loud enough for all to hear. Players do not need to wait until the definition is finished.
6. If the word given by a player was correct, the puck is moved one position toward the opponent's net.
7. The first person to run out of cards in hand wins the game. However, he/she must display the cards discarded, in pairs, for the judgment of the group. In case of any disagreement, the moderator checks the list of terms and definitions and the moderator's decision is final. If any mismatched pairs have been claimed as matching pairs, the player must put these back in his/her hand, plus one card from the top of the stack for each unmatched pair claimed, and the game continues.

TEACHER INFORMATION

Object of the Game:
To put the hockey puck in the opponent's net, by recognizing definitions of mining terms and selecting the words from a list.

Prior Preparation:
1. Prepare a list of words, written large enough for participants to see. Use any words from the glossary that are appropriate for the group involved.
2. Prepare a second list of the same words, complete with definitions. This one is used by the moderator.
3. Prepare a game board. See example below:

OPTION:
Instead of displaying the list of words, participants to recall the words from memory.



ANSWERS

Crossword Puzzle #1

Across
1. Impurities
2. Restoration
3. Crystal
4. Pollution
5. Equipment
6. Mineral
7. Fossil

Down
1. Intrusive
8. Explosive
9. Hardness
10. Prospector
11. Mine
12. Drilling
13. Mining
14. Natural

Crossword Puzzle #2

Across
1. Core
2. Exploration
3. Lead
4. Mine
5. Formation
6. Prospector
7. ore
8. Metamorphic

Down
9. Crystal
10. Sedimentary
11. Mohs
12. Fossil
13. Restoration
14. Derrick
15. Granite
16. Smut
17. Copper
18. Nonmetallic
19. Cavern
20. Acid
21. Amigo

Crossword Puzzle #3

Across
1. Intrusive
2. Potash
3. Mining
4. Sedimentary
5. Shaft
6. Explosive
7. Geology
8. Reclaim
9. Tunnel
10. Damp

Down
11. Nonmetal
12. Mineral
13. Core
14. Metamorphic
15. Ore
16. Concentrate
17. Machine
18. Hoist
19. Sand
20. Lead
21. Ash
22. Pump
23. Fault
24. Areometer
25. Arid
26. Ingot
27. Opal
28. Hone

MINING WORD SEARCH 2

B A M I N I N G A I D K J L W T
P O U K G N R S F A O U Y M H I
C H E M I S T D I A S H S S X N
L M I O B T W E C U J I U O L K
P E F M A R K E T C S M B I E W
E K N A L U L B R Y E O S M N S
T U N O P M W D L A T S Y R C V
R U J H G E A O R T O J N B R T
O L M N T N R I A F I H B P M N
L V B Y I T L O A V T X L R O W
E C S A C J U I L N T D E O Q U
U U G E O L O G Y A W E V S Y T
M O L M D T Y R L M N O P P E A
B E X P L O S I V E T R H E L O
Z S M E L T I N G Q U O T C K Y
V U O L B F K D G A O U J T M N
I M P U R I T I E S A E D O N H
V U Q R E U L N G I U F O R W V
A E V T Y M O G M B S T I H B W

CHEMIST
EXPLOSIVE
GRINDING
MARKET
PROSPECTOR
CRYSTAL
FOSSIL
IMPURITIES
MINING
SMELTING
ELECTROLYSIS
GEOLOGY
INSTRUMENT
PETROLEUM

MINING WORD SEARCH 3

A N O K L M T I Z C T G H F U Y
N O G R T B A L N Y U Q P I Z A
S I R B R A F B L D M C T L A S
N T A X A K M U H V U S A T O N
F A N L N W R S O U T S Y E K L
O C I N S E A L Q U O P T R W Z
N I T C P T I U T M N B W R C V
B F E K O B S I D I A N Y R Y L
Q I N P R P U T O N O R S T Y N
A D T N T O P R A E S T I C R N
W I Q U I N N E E P N O D I E K
P L U Q W R T A R B C X A V S E
A O V T H I J L M N K Y E T T M
W S A O M N R C I T B Q L T O M
E X H A U S T T I L A T B F R L
R E N O R A L T O A H I S T A W
C Y O M E T A L L U R G I S T P
D R O H N O M I N O G H T Y I B
D E R L O U G H T Y V O G E O L
Q U E R T A T I O N A R Y M N E

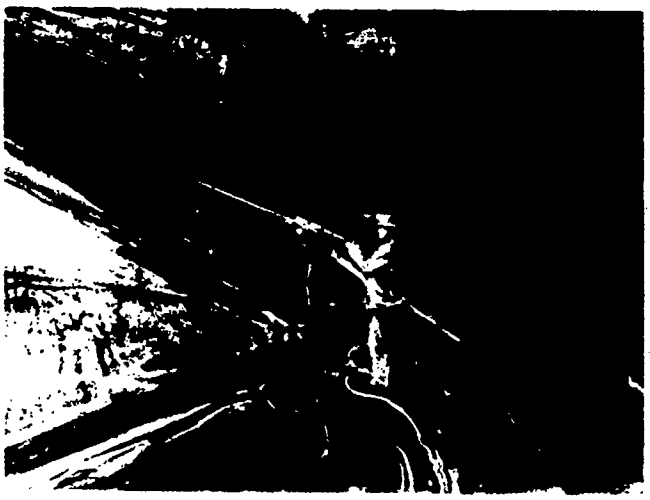
COPPER
FILTER
LEAD
OBSIDIAN
SALT
DYNAMITE
GRANITE
METALLURGIST
POTASH
SOLIDIFICATION
EXHAUST
INDUSTRY
MINE
RESTORATION
TRANSPORT

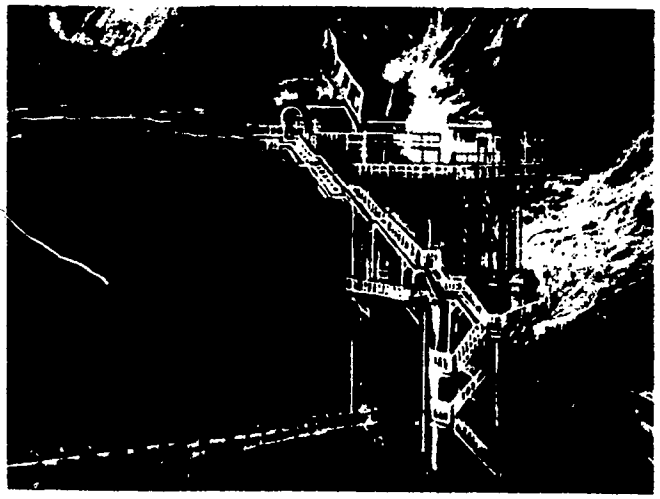
MINING WORD SEARCH 1

In addition to having students do the "Word Search" activities, consider having them prepare new "Word Search" activities for classmates to do. Learning gains will be even greater in making the activity than in doing it as a game.

S W T A O P L Q I D Z Y E T H V D S A
X V N A A T T H J Z Q P N H W S A I S
C T L O L R M E T A L L I C O M I S T
A Y M O P U J E I P M N H I W I B L E
D C A E L E M E N T T R C I T N O T M
S Y P O A Y B I G B M T A R E E A L K
D L O G W Q R N N U L A M T V R X A L
B N L R F M E G J U W S G Z E A K V C
M Y L T W S C O H B M R H M A L O Z T
R F U N B T L T H O M G O P U E Y B N
U H T U S O A K V F E L D S P A R T K
T U I I H B M O P T G U R L X V E A T
W N O G A I A N T N E D I J K T R S A
Q H N O F A T N O G E O L O G I S T E
W S C V T B I C M A E J L U H G F A M
F C Y H N W O K U I O D Z S A P L M A
J M L A O H N W O L H D C B N W I O P

ALUMINUM
ELEMENT
GOLD
MACHINE
POLLUTION
CONGLOMERATE
FELDSPAR
HOIST
METALLIC
RECLAMATION
DRILL
GEOLOGIST
INGOT
MINERAL
SHAFT





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